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Wicaksono, Wirawan H.

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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

STRATEGIC PLANNING OR INNOVATION INSTITUTIONALIZATION? THE CASE OF SINGAPORE ARMED FORCES' MODERNIZATION

by

Wirawan H. Wicaksono

June 2020

Thesis Advisor: Rodrigo Nieto-Gomez
Second Reader: John M. Sheehan

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13. ABSTRACT (maximum 200 words)

Singapore, as a newborn country in the mid-1960s, was economically, politically, and strategically unviable on its own. However, despite its humble start, Singapore has built the most well-equipped military in Southeast Asia. While neighboring countries had similar governmental apparatuses and economic-political situations, only Singapore managed to modernize its armed forces at a significant rate and achieve a remarkable result.

Thus, this situation raises the following question: what method has enabled Singapore to modernize its military successfully? Drawing from the broader Singapore military studies and business and management strategies literature, this thesis finds that during the early stages, Singapore implemented predefined situation-based development—strategic planning—assisted by Israeli military advisers. In the next stage, thanks to its heavy investment in training and education, Singapore started to cultivate innovation in its military personnel, which increased its modernization pace, while still implementing strategic planning. In the current stage, Singapore's military modernization pace is barely challenged regionally, propelled by thriving innovation due to its establishment of dedicated organizations that act as innovation engines. Overall, Singapore's achievement was not brought about by strategic planning or innovation institutionalization alone but by the proper combination of the two.

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STRATEGIC PLANNING OR INNOVATION INSTITUTIONALIZATION? THE CASE OF SINGAPORE ARMED FORCES' MODERNIZATION

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ABSTRACT

Singapore, as a newborn country in the mid-1960s, was economically, politically, and strategically unviable on its own. However, despite its humble start, Singapore has built the most well-equipped military in Southeast Asia. While neighboring countries had similar governmental apparatuses and economic-political situations, only Singapore managed to modernize its armed forces at a significant rate and achieve a remarkable result.

Thus, this situation raises the following question: what method has enabled Singapore to modernize its military successfully? Drawing from the broader Singapore military studies and business and management strategies literature, this thesis finds that during the early stages, Singapore implemented predefined situation-based development—strategic planning—assisted by Israeli military advisers. In the next stage, thanks to its heavy investment in training and education, Singapore started to cultivate innovation in its military personnel, which increased its modernization pace, while still implementing strategic planning. In the current stage, Singapore's military modernization pace is barely challenged regionally, propelled by thriving innovation due to its establishment of dedicated organizations that act as innovation engines. Overall, Singapore's achievement was not brought about by strategic planning or innovation institutionalization alone but by the proper combination of the two.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACMS	Advanced Combat Man System
AEW&C	Aerial Early Warning & Control
AMDA	Anglo-Malaysian Defence Agreement
APC	Armored Personnel Carrier
ASEAN	Association of Southeast Asian Nation
BG	Brigadier General
C2C	Creating Capacity to Change
C4	Command, Control, Communications and Computers
C4ISR	Command, Control, Communications, Computers, Intelligence Surveillance, and Reconnaissance
DRTO	Defense Research and Technology Office
DSO	Defence Science Organisation
DSTA	Defense Science and Technology Agency
ETC	Electronic Training Centre
FPDA	Five Power Defense Arrangement (UK, Australia, New Zealand, Malaysia, Singapore)
FSD	Future Systems Directorate
GDP	Gross Domestic Product
HADR	Humanitarian Assistance and Disaster Relieve
IDF	Israel Defense Forces
IFV	Infantry Fighting Vehicle
IKC2	Integrated Knowledge-based Command and Control
ISD	Internal Security Department
MBT	Main Battle Tank
MHA	Ministry of Home Affairs
MID	Ministry of the Interior and Defence
MINDEF	Ministry of Defence
MPA	Maritime Patrol Aircraft
NCO	Non-commissioned Officer
NSF	National Service Force

OOTW	Operation Other than War
PAP	People's Action Party
RAF	Royal Air Force
RMA	Revolution in Military Affairs
RMNVR	Royal Malayan Naval Volunteer Reserve
RSN	Republic of Singapore Navy
RSAF	Republic of Singapore Air Force
SAF	Singapore Armed Forces
SAFTI	Singapore Armed Forces Training Institute
SIR	Singapore Infantry Regiment
SLOC	international sea lanes of communication
SNVF	Singapore Naval Volunteer Force
SOMS	straits of Malacca and Singapore
SPF	Singapore Police Force
SPH	Self-propelled Howitzer
ST	Singapore Technologies
SWOT	Strengths Weaknesses Opportunities and Threats
UAV	Unmanned Aerial Vehicle
ULV	Unmanned Land Vehicle
UN	United Nations
USV	Unmanned Surface Vehicle
U.S. DOD	United States Department of Defense
WTO	World Trade Organization
0G	0 Generation
1G	1st Generation
2G	2nd Generation
3G	3rd Generation
4G	4th Generation

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I. INTRODUCTION

This thesis answers the question: what are the main factors which explain Singapore's success in modernizing its military within the span of fifty years, from the mid-1960s to the mid-2010s?

Singapore is an island city-state at the tip of the Malayan peninsula, surrounded by two larger Malay Muslim–dominated states, Malaysia and Indonesia, as shown in Figure 1. Singapore has a territory about 3.5 times bigger than Washington, DC, and is populated by around six million people.[1]

Figure 1. Singapore Location[2]

This island city-state was powerless, vulnerable, and struggled with its social, political, and economic problems as a newborn country in the mid-1960s. Singapore was

[1] "The-world-factbook-singapore," Central Intelligence Agency, accessed September 11, 2019 https://www.cia.gov/library/publications/the-world-factbook/geos/sn.html/

[2] Adapted from Whiddon, L., Weldon Owen Inc Staff, Barnes & Noble Books, and Weldon Owen Pty Limited. *The Illustrated World Atlas*. Barnes & Noble, Incorporated, 2004.

economically, politically, and strategically unviable on its own.[3] In addition, the premature withdrawal of British colonial forces, in the early 1970s, made Singapore near defenseless and more vulnerable against internal and external threats.

Despite its humble start and history of relying on its meager military resources,[4] Singapore operates the most reliable air force and the most modern navy in Southeast Asia[5] and a robust, well-equipped army. As ranked by *Military Balance* in 2019, the SAF are the best-equipped military in Southeast Asia,[6] manned by well-trained personnel and, as characterized by Eliot Cohen, "molded a technologically sophisticated and large military that is capable of striking far from the island state."[7] The *Military Balance* 2019 also mentioned that the modern Singapore Armed Forces (SAF) are backed by 72,500 regular military personnel along with 312,500 reservists.[8] For decades, the island-city state has positioned itself as the region's biggest defense spender. In 2018, the Singaporean government allocated around US$10.8 billion for its annual defense budget.[9] That annual defense budget even surpassed the defense budget of the region's biggest economy, Indonesia, which allocated an annual defense budget of about US$7.4 billion, and Thailand in third place at around US$6.8 billion.[10]

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[3] Tim Huxley, *Defending the Lion City: The Armed Forces of Singapore* (New South Wales, Australia: Allen & Unwin, 2003), 2.

[4] Huxley, *Defending the Lion City*, 10.

[5] Ben Brimelow, "How a city-state became a military powerhouse with the best air force and navy in the Southeast Asia" *Business Insider*, last modified April 8, 2018. https://www.businessinsider.com/singapore-military-best-air-force-navy-southeast-asia-2018-4

[6] Institute for Strategic Studies, "Chapter Six: Asia." *The Military Balance* 119, no. 1 (February 1, 2019): 303. https://doi.org/10.1080/04597222.2018.1561032.

[7] Cited in Evan A. Laksmana, "Threats and Civil-Military Relations: Explaining Singapore's 'Trickle down' Military Innovation." *Defense & Security Analysis* 33, no. 4 (October 2, 2017): 347–65.

[8] Institute for Strategic Studies, "Chapter Six: Asia," 303.

[9] Stockholm International Peace Research Institute, "Fact sheet—Trends in World Military Expenditure, 2018," accessed April 25, 2019, https://www.sipri.org/sites/default/files/Data%20for%20all%20countries%20from%201988%E2%80%932018%20in%20constant%20%282017%29%20USD%20%28pdf%29.pdf.

[10] Stockholm International Peace Research Institute, "Fact sheet—Trends in World Military Expenditure, 2018."

Singapore has thus succeeded in transforming its armed forces, from only two infantry battalions into the most capable and modern in the region, within the span of a mere four decades. The SAF, helped by the Israel Defense Forces (IDF), has continuously innovated since the 1960s—technologically, organizationally, and conceptually.[11] But what is particularly peculiar about Singapore's achievement in modernizing its military is that, while neighboring countries had similar governmental apparatuses, with only slightly different initial economic-political situations, only Singapore managed to modernize its armed forces at a significant rate and achieve a remarkable result—an issue that has received little attention from scholars, despite the fact that Southeast Asia is a region with a significant maritime geostrategic role for wider Asian and global security.[12]

A. SIGNIFICANCE

Understanding this issue is crucial for the neighboring countries, in order to help them balance Singapore's military modernization. International realists believe that international politics are anarchic and that countries pursue their natural behavior based on the concept of social equilibrium, which is that it is the nature of a system to find its stability within an environment composed of a number of autonomous forces.[13] Realist countries believe that power balancing is the best guarantee of maintaining world security and peace.[14] These countries balance their power appropriate to their interests based on knowledge about other states; as the only thing that maintains peace is the absence of clashed interests, this corresponds to Thucydides' statement: "identity of interests is the surest of bonds whether between states or individuals."[15] However, in the case of Singapore, this process does not work in the usual way: despite Singapore's success in modernizing its military, it does not publish many defense-policy documents in the way

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[11] Laksmana, "Threats and Civil-Military Relations," 1.

[12] Geoffrey Till and Jane Chan, *Naval Modernisation in South-East Asia: Nature, Causes and Consequences* (Abingdon, Oxon: Routledge, 2014), 223.

[13] Hans Joachim Morgenthau, *Politics Among Nations: The Struggle for Power and Peace*. 5th ed. (New York: Knopf; Random House, 1973), 168.

[14] Kenneth Neal Waltz, *Theory of International Politics*. 1st ed. (New York: McGraw-Hill, 1979), 117.

[15] Morgenthau, *Politics Among Nations*, 8.

that other militarily modern states do, as mentioned in *Military Balance* 2019;[16] in any Singapore-related defense publications from various sources that are available for public viewing, the quality and depth of the elaboration are far from what other countries have released;[17] and very few studies are available on this topic.

Therefore, ensuring national security and addressing future threats with the proper knowledge and approach is crucial, otherwise it could lead Singapore's neighbors to bankruptcy, isolation, and political crisis, it could even end up losing a war. Firstly, as resources are not unlimited, pursuing military buildup unwisely can deplete states of resources. Building strong military forces heavily depends on economic strength, in the absence of good economic management; the expense of building, operating, and maintaining military forces would be too high to afford, which could lead to disaster. For instance, there was the case of the Soviet Union, a poorly managed country that insisted on balancing the better managed United States[18]—militarily only, combined with its infamously inflexible communist system, to the world's dynamics—which led to its collapse in 1989. Second, states seek to counter the actual threat proportionally because they do not want to be seen as aggressive actors, which could cost them international sympathy. Balancing excessively based on assumptions will almost certainly lead them into the Thucydides Trap, where the tension between states that increase their power are more likely to provoke war.[19] On the other hand, balancing insufficiently leaves states vulnerable to future threats.

Accordingly, this research fills the gap in knowledge about the Singapore Armed Forces' modernization, providing information to satisfy the curiosity of Singapore's neighbors as to what factors enabled Singapore's success in modernizing its military. Understanding how Singapore carried out the modernization of its military could help

16 Institute for Strategic Studies, "Chapter Six: Asia," 303.

17 Till and Chan. *Naval Modernisation in South-East Asia*, 228.

18 Chris Miller, *The Struggle to Save the Soviet Economy Mikhail Gorbachev and the Collapse of the USSR* (Chapel Hill: University of North Carolina Press, 2016), 173.

19 Anne Kim, Richard Ned Lebow, and Daniel P. Tompkins, "The Thucydides Claptrap," *Washington Monthly*, June 28, 2016, https://washingtonmonthly.com/thucydides-claptrap, 1.

regional policymakers and military leaders who want to follow Singapore's example in order to balance Singapore's military modernization, successfully, without going bankrupt or triggering suspicion.

B. HISTORICAL BACKGROUND

Understanding the drivers behind Singapore's military modernization requires a knowledge of Singapore's history, because Singapore's security paradigm is traditionally based on a combination of both internal and external variables: its historical legacies, geostrategic position, and natural constraints. First, Singapore experienced traumatic ethnic riots around its early period of independence, 1965, which raised its fear of being persecuted by its two immediate neighbors, Malaysia and Indonesia. Second, Singapore's security perception always involved its geostrategic and geopolitical position, located along the confluences of vital international sea lanes of communication (SLOC) connecting the Indian Ocean and the South China Sea (Figure 2). The SLOC is Singapore's main economic lifeline, placing the Strait of Malacca and Singapore (SOMS) as the main area of concern of Singapore's security paradigm. The last variable is Singapore's natural constraints on its demographics, lack of territory, and natural resources. This situation forced Singapore, as a small island nation, to find innovative approaches to deal with its constraints and produce an effective defense capability amid the uncertainty of its continuously evolving security challenges.

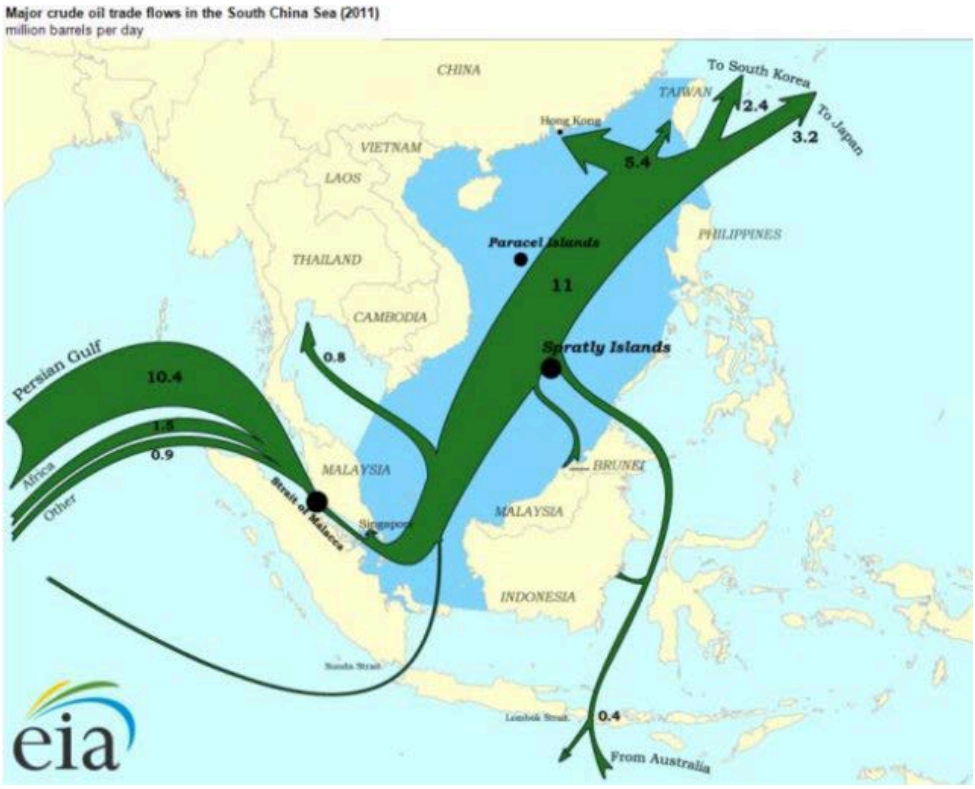

Figure 2. Major Crude Oil Shipping Routes through Southeast Asia[20]

Ancient Singapore was also known as *Tumasik*, which means "sea town" in old Javanese, before it was occupied by Thomas Stamford Raffles, a scholar and governor of British Bencoolen; Singapore became a British Strait Settlement in 1826, and then a separate British colony in 1946, governed by a civil administration and led by a governor.[21] In 1963, Malaya, Singapore, Sabah, and Sarawak merged, officially forming Malaysia. However, due to political and ethnic disagreement, on August 9, 1965, the Malaysian parliament voted for a constitutional amendment expelling Singapore from the federation; this event was crucial in shaping Singapore's defense perspective, with Malaysia as its most likely adversary.[22]

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[20] Source: U.S. Energy Information Administration, "EIA 2013," accessed on January 24 2020, http://www.eia.gov/todayinenergy/ detail.cfm?id=10671.

[21] Robert S. Milne and Diane K. Mauzy, *Singapore: The Legacy of Lee Kuan Yew* (Boulder: Westview Press, 1990), 2.

[22] Huxley, *Defending the Lion City*, 45.

Singapore thus experienced a humble start as a nation. Singapore was only a war-torn port city with a small domestic market, without a hinterland and natural resources, and struggling with social issues such as public housing, sanitation, and unemployment. Furthermore, Singapore experienced traumatic ethnic violence and assertion from its immediate neighbors, around 1950–69, resulting in its fear of persecution. The first big ethnic violence between Malay and Chinese happened in 1950, known as the Maria Herthogh riot. It was caused by a custody rights dispute between the foster mother and biological parents over a thirteen-year-old Dutch girl. The second incident was the *Maulid* riot, anti-Chinese violence on a Moslem holiday, and again a spillover of violence in 1969 from another anti-Chinese riot in Kuala Lumpur.

As a secondary concern, there was *Konfrontasi Dwikora*—Confrontation Campaign—the aggression of Indonesia, another predominately Malay-Muslim country, towards the island city-state in the early 1960s, wherein Soekarno's regime opposed the formation of the Federation of Malaya by the British colonials.[23] Moreover, during the late 1960s and early 1970s, it was common to portray Singapore as a "Chinese nut in a Malay nutcracker," between two bigger predominantly Malay-Muslim countries following the post-Confrontation period.[24]

These concerns have heavily influenced the Singaporean security perspective ever since. Due to Singapore's traumatic experience with ethnic violence, Singapore's leaders' initial appraisal found that the Chinese ethnic dominated island city-state has ethnic violence as its primary internal concern, and Malaysia and Indonesia as its external concerns.[25] Overall, Singapore's security paradigm seems to reflect the international political realists' characteristics: self-interest, survival-seeking, believing in anarchic international politics, always afraid, power as solution, embracing competition, preparing for conflict, distrusting others (including allies), indifference to justice/morality,

[23] Malcolm H. Murfett, *Between Two Oceans: A Military History of Singapore from First Settlement to Final British Withdrawal* (Oxford: Oxford University Press, 1999), 313.

[24] Huxley, *Defending the Lion City*, 51.

[25] "Kishore Mahbubani: Freedom of the Press in Singapore," April 3, 2012, Big Think, 2:33 https://www.youtube.com/watch?v=u8sykIHdvoI.

pragmatic.[26] All of these properties shaped Singapore's security perspective, i.e., these properties are reflected in the formation and transformation of the SAF.

C. SINGAPORE ARMED FORCES' FORMATION AND TRANSFORMATION

During the 1950s–1960s, the British provided financial and practical defense assistance to its remaining territories in the far east: Singapore, North Borneo, Sarawak, Brunei, and Hong Kong, through the Anglo-Malaysian Defence Agreement (AMDA).[27] Due to Singapore's status as a British ex-colony, its defense heavily depended on the British Empire until the last stationed British soldier left Singapore.[28] As described by Tim Huxley, during this time "Singapore was hardly defenseless against external threats, given not only the close defense relationship with Malaysia but also the massive British military presence,"[29] which performed very well during Soekarno's unsuccessful Confrontation Campaign against the Federation of Malaysia, which Singapore was part of, in 1962–66.

However, Singapore's role as a state in this federation was short-lived, as Singapore was expelled on August 9, 1965, initiated by Malaysian Prime Minister, Tunku Abdul Rahman.[30] In this period, everything changed drastically, including the future of Singapore's defense. Singapore felt that the British forces would be unwilling or unable to intervene if a conflict between Singapore and Malaysia occurred. This thought was based on the fact that the British could not prevent nor provide a political solution during the expulsion of Singapore.[31] Even Lee Kuan Yew himself called the idea of an independent and separate Singapore "a political, economic and geographical absurdity."[32]

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[26] Emily Meierding, "International Relation-Clasical Realism" (lecture, Naval Postgraduate School, Monterey, CA, July 15, 2019).

[27] Huxley, *Defending the Lion City*, 2–3.

[28] Murfett, *Between Two Oceans*, 327.

[29] Huxley, *Defending the Lion City*, 8.

[30] Murfett, *Between Two Oceans*, 315.

[31] Murfett, 316.

[32] Michael Raska, *Military Innovation in Small States: Creating a Reverse Asymmetry* (New York: Routledge, 2016), 133.

Concomitantly, S. Rajaratnam, Singapore's first foreign minister, stated that an independent Singapore had a "near-zero chance of survival—politically, economically, or militarily."[33]

In this period, Singapore had almost nothing to ensure its defense, as it had no proper defense force at all. Singapore had only two infantry battalions, which were trained and equipped mainly for internal security operations, and two-thirds of these units were Malaysians.[34] Singapore's circumstances were worsened by the withdrawal of the British forces, which left Singapore with no option but to rely on itself. Even though the United Kingdom came with a new concept of defense arrangement in order to compensate for its forces' withdrawal, Singapore felt hopeless. Only Singapore, compared to its two immediate neighbors, recognizes the utility of a power balancing mechanism in maintaining its security. Therefore, due to the involvement of its primary source of threats, Malaysia, in the new concept, Singapore considered even more seriously a "self-reliant" force posture, a force posture designed to address any regional threats independently, disregarding its constraints and unfavorable circumstances.

With maintaining its independence as Singapore's top priority, its founding father implied that it was important for Singapore to have an "overwhelming power"[35] on its side. Therefore, despite the supposedly hopeless situation, led by Lee Kuan Yew's close friend, Dr. Goh Keng Swee, who was also Lee's political associate, Singapore immediately established a new institution called the Ministry of the Interior and Defence (MID). Goh Keng Swee's team quickly looked for foreign military assistance, aiming to build a credible and large military force.[36] Realizing that it could no longer rely on British forces, Singapore sought assistance from Switzerland, India, Egypt, and Israel;[37] none of them

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[33] Raska, *Military Innovation in Small States*, 133.

[34] Obaid Ul Haq, "Singapore's Search for Security: A Selective Analysis" in *Leadership and Security in Southeast Asia*, Stephen Chee (ed.) (Singapore: Institute of Southeast Asian Studies, l991) p.130.

[35] Huxley, *Defending the Lion City*, 33.

[36] "Singapore Plans a Big Build-Up of Military Force Over 10 Years," *New York Times*, December 4, 1968, 16, ProQuest.

[37] Huxley, *Defending the Lion City*, 11.

responded to Singapore's request, except for Israel which gave a positive response and agreed to supply the newborn country with military mission teams, to assist Singapore form its own defense forces.

Previous research concludes that the Singapore Armed Forces transformation has undergone three distinct phases. These phases are described in a master's thesis by Naval Postgraduate School student Yong Jia Rong, using the SAF zoological analogies: "Poisonous Shrimp," "Porcupine," and "Dolphin." The summary of this zoological characterization of Singapore Armed Forces evolution is presented in Table 1.

Table 1. Evolution of Singapore Armed Forces—Summary of Characteristics[38]

Strategy	Threat Designed to Addressed	Key Focus	Type of Deterrence	Primary Executing Service
"Poisonous Shrimp" late 1960s–early 1980s	Conventional military threats	Basic defense and survival: • Prevent successful invasion • Maintain internal stability	Passive Deterrence: • Strong defensive capability a. Infantry-centric) • Fight in own territory • Cause substantial damage to enemy	ARMY
"Porcupine" early 1980s–early 2000s	Conventional military threats	Enhanced survivability: • Enhanced deterrence factor • Creation of strategic depth Establishment of regional political space: • Superior military capabilities	Active Deterrence: • Strong pre-emptive military capability a. Armor and airstrikes • Fight in enemy territory; limited sea denial • Win the war or cause unacceptable damage to enemy • Limited protection of economic interests	RSAF

[38] Adapted from, Jia Rong Lester Yong, "Why Keep Changing? Explaining the Evolution of Singapore's Military Strategy Since Independence" (master's thesis, Naval Postgraduate School, 2009), 10, http://hdl.handle.net/10945/52956.

Strategy	Threat Designed to Addressed	Key Focus	Type of Deterrence	Primary Executing Service
"Dolphin" early 2000s - present	Conventional military and non-conventional threats	Enhanced survivability: • Enhanced strategic depth • Full-spectrum dominance Establishment of international political space • Defense diplomacy	Preventive Deterrence: • Overwhelming military superiority a. Network-centric and Joint operations b. Capable of dealing with non-conventional threats • Fight in enemy territory; limited sea control • Cooperation and confidence building a. Information and intelligence sharing b. HADR and OOTW • Prevent thought of harming Singapore to even take shape • Improved protection of economic interests	RSN

Though never explicitly defined by government officials, according to Yong, it is "possible to [synonymously] associate the three analogies with the three generations of evolution of the SAF."[39] Scholars and Singaporean leaders use the zoological analogies to portray the SAF's acquired capabilities, intended use, and projected image and posture. These analogies also portray the evolution or modernization of SAF's approaches to achieve its stated mission, as stated by Yong: "to enhance Singapore's peace and security through deterrence and diplomacy, and should these fail, to secure a swift and decisive victory over the aggressor."[40]

Based on Yong's findings, in the early stage, "Poisonous Shrimp"—small and easy to swallow but hardly digestible—Singapore's goal was to raise "an aggressor's cost of attacking [a small] Singapore to such an undesirable level that no country would consider invading it."[41] In this stage the SAF was modest, passively defending the nation and centered primarily on deterrence of external threats and internal security; therefore, the Singapore Army was the top priority. In the Porcupine stage, Singapore adopted a farther reaching posture than "shrimp" but with "spines" that could injure the enemy—a posture that "at least [possesses] limited military power (the porcupine's quills) at some distance from its shores."[42] In this second stage, the SAF sought to achieve enhanced survivability through military power projection and preemptive strike capability, defeating the enemy in their territory. Lastly, the Dolphin is characterized as a posture with "intelligence, speed, and maneuverability in a spectrum of diverse missions: from defense diplomacy and operations other than war to kinetic precision strike capabilities conducted further afield from the immediate environment of Singapore."[43] In this current stage, the SAF aimed to sharpen its capability uses intelligence, speed, and enhanced maneuverability in a diverse

[39] Yong, "Why Keep Changing? Explaining the Evolution of Singapore's Military Strategy," 5.

[40] Yong, 5.

[41] Yong, 6.

[42] Yong, 7.

[43] Yong, 8.

mission spectrum: from defense diplomacy and operations other than war to kinetic precision strike capabilities, carried out beyond Singapore's immediate territory.[44]

Today, according to *Military Balance*, 2019 edition, the Republic of Singapore Air Force (RSAF) is equipped with 114 modern fighter aircraft along with 19 modern attack helicopters, supported with AEW&C and long-range projection capabilities. The RSAF recently announced its plan to operate the F-35.[45] The Republic of Singapore Navy (RSN) has six modern stealth frigates, four upgraded ex-Swedish submarines (with Air Independent Propulsion-AIP capability), along with 18 heavily armed modern combatant vessels in its inventory, supported by amphibious operation capability. The RSN plans to operate the region's most sophisticated submarine, Type 218SG, in 2021. The Singapore Army has three armored brigades, nine infantry brigades, an airmobile brigade, an amphibious brigade and a battalion of special force. This force is supported by more than 450 tanks (Leopard-2SG main battle tank + AMX-10/13 light tank), more than 550 infantry fighting vehicles (IFV), more than 1500 armored personnel carrier (APC) vehicles, and almost 800 artillery guns (including the sophisticated M142 HIMARS systems, and locally built self-propelled howitzer-SPH).

[44] Raska, *Military Innovation in Small States*, 146.

[45] Eng Hen Ng, "Transforming the SAF to Meet a More Troubled Environment," Singapore Mindef, March 1, 2019, https://www.mindef.gov.sg/web/portal/mindef/news-and-events/latest-releases/article-detail/2019/March/01mar19_speech

Table 2. Regional Power Balance

Year	Variables	Singapore	Malaysia	Indonesia
1975[46]	Defense Budget/ % GDP (in US$ million/%)	366/ 5.4	619/ 4.7	1,312.5/ 3.6
	Army (pers/tank/APC/artillery)	30,000/ 75/ 530/ 60	52,500/ 0/ 400/ 80	180,000/ 325/ 220/ 176
	Navy (Surface/Sub/Air)	28/ 0/ 0	40/ 0/ 0	50/ 3/ 35
	Air Force (Fighter/others/rotary)	57/ 56/ 20	16/ 72/ 69	16/ 112/ 55
1985[47]	Defense Budget/ % GDP (in US$ million/%)	1,046 (1984)/ 6.31	1,976 (1984)/ 6.06	2,527 (1984)/ 3.47
	Army (pers/tank/Armored Vehicle/artillery)	45,000/ 270/ 1000/ 60	90,000/ 26/ 949/ 114	216,000/ 111/ 430/ 200
	Navy (Surface/Sub/Air)	33/ 0/ 0	52/ 0/ 0	84/ 2/ 33
	Air Force (Fighter/others/rotary)	93/ 112/ 51	39/ 79/ 67	44/ 80/ 44
1993[48]	Defense Budget/ % GDP (in US$ million/%)	2,130 (1991)/ 5.29	1,960 (1992)/ 3.55	1,770 (1992)/ 1.38
	Army (pers/tank/APC/artillery)	45,000/ 350/ 1,022/ 142	85,000/ 26/ 701/ 199	202,900/ 125/ 465/ 180
	Navy (Surface/Sub/Air)	38/ 0/ 0	51/ 0/ 12	101/ 2/ 43
	Air Force (Fighter/others/rotary)	151/ 76/ 51	54/ 43/ 54	68/ 95/ 54
2005[49]	Defense Budget/ % GDP (in US$ million/%)	4,300/	2,300/	1,100/
	Army (pers/tank/APC/artillery)	50,000/ 450/ 750/ 224	80,000/ 26/ 1,020/ 164	233,000/ 335/ 356/ 185
	Navy (Surface/Sub/Air)	33/ 3/ 5	54/ 0/ 6	107/ 2/ 69
	Air Force (Fighter/others/rotary)	125/ 79/ 93	74/ 40/ 40	75/80/ 38
2019[50]	Defense Budget/ % GDP (in US$ million/%)	11,000 (2018)/ 3.17	3,870 (2018)/ 1.1	7,320 (2018)/ 0.72
	Army (pers/tank/APC/artillery)	50,000/ 468/ 2,148/ 798	80,000/ 69/ 1,082/ 424	300,400/ 429/ 634/ 1,198
	Navy (Surface/Sub/Air)	42/ 4/ 13	64/ 2/ 12	161/ 4/ 68
	Air Force (Fighter/others/rotary)	100/ 54/ 70	47/ 124/ 59	49/ 177/ 36

46 Source: Ronald Huisken, *Defence Resources of South East Asia and the South West Pacific: A Compendium of Data*. Canberra: Strategic and Defence Studies Centre, Research School of Pacific Studies, Australian National University, 1980, 1–33.

47 Source: Institute for Strategic Studies, "Asia and Australasia." *The Military Balance 1984–1985* (London: The Garden City Press, 1985), 111–137.

48 Source: Institute for Strategic Studies, "East Asia and Australasia." *The Military Balance 1993–1994* (London: Brassey's Ltd, 1993), 146–172.

49 Source: Institute for Strategic Studies, "East Asia and Australasia." *The Military Balance 2004–2005* (London: Oxford Univ. Press, 2004), 161–193.

50 Source: Institute for Strategic Studies, "Chapter Six: Asia." *The Military Balance* 119:1, 222–319.

D. POTENTIAL EXPLANATIONS AND HYPOTHESES

Based on a common idea in managerial literature that good management is the key to success and strategic planning is a roadmap to organizational success—e.g., General Electric's success story as the beacon of strategic planning and the popularity of the strength, weakness, opportunity, and threat (SWOT) analysis among regional military leaders—the most plausible explanation for why Singapore has succeeded at modernizing its military where other states in the region have not is that the SAF properly formulated its strategic planning. This possibility is indicated by the fact that most of the chiefs of services in SAF once held the posts of Head of Joint Plans and Transformation Department of their respective services or general staff.

On the other hand, another possible explanation is innovation institutionalization, a more flexible alternative compared to strategic planning. As characterized by Michael Raska, Singapore has been highly innovative and adaptive in dealing with international and regional political and economic dynamics, evidenced by the three main shifts in the evolution of the SAF. Singapore's success story, therefore, could have been enabled by its capability for being highly adaptive and innovative in dealing with international and regional politics and economic dynamics during each shift. As Scott D. Anthony et al., point out, innovation institutionalization is "an effort to build an engine that produces a steady stream of innovative growth,"[51] in order to gain superiority over competitors. Thus, this approach of institutionalizing innovation could have enabled Singapore to differentiate itself from its regional competitors and gain significant superiorities in the defense realm.

E. RESEARCH DESIGN

Drawing from the two most widely used approaches in achieving organizational success—strategic planning and innovation institutionalization—this research examines how Singapore successfully modernized its armed forces. This research will utilize historical analysis, comparative studies, and case studies as the primary methods in examining the relationship between Singapore's military modernization conceptualization

[51] Scott D. Anthony, Mark W. Johnson, and Joseph V. Sinfield. "Institutionalizing Innovation." *MIT Sloan Management Review*; Cambridge 49, no. 2 (Winter 2008): 45.

and implementation in every transformation phase with contemporary military modernization efforts in the neighboring countries. Overall, this research discusses the approaches Singapore took and how it managed to modernize its military, and what made Singapore's approaches so successful while neighboring countries did not succeed.

Data and information will be taken from Singapore's various defense-related publications from the 1950s to the present. Official speeches, defense data, and other related documents from other credible parties are part of the comparative studies in this research. Additionally, analytical studies on collected data, related to regional issues, from credible regional and international media sources provide additional information. Literature on management, defense planning, strategic planning, innovation institutionalization, policy history, military strategic thinking, military innovation, and other related publications support the primary resources of study. Historical analysis is also part of the research process, to provide a better understanding of the relationships between variables.

F. CRITIQUE

How can strategic planning and innovation institutionalization, which many publications categorize as part of business and management strategies literature, apply to a military organization, which does not pursue profit, like a commercial company does?

Although, the idea of private companies' profit-seeking orientation does not seem fit in the defense realm, actually it does. As Charles J. Hitch, and Roland N. McKean argue, in the defense realm, there are many similarities to private company such as an objective, budgetary and other resource constraints, and also a challenge to economize.[52] Moreover, strategy and cost are interdependent: as he characterized, it is like the front and the rear sights of a rifle.[53] This characterization means that it is impossible to get a good result by adjusting one of the rifle's sights only. Therefore, the idea of strategic planning and innovation institutionalization are applied to the defense realm.

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[52] Charles J. Hitch, and Roland N. McKean. *The Economics of Defense in the Nuclear Age* (Cambridge: Harvard University Press, 1960), 2.

[53] Hitch and McKean, *The Economics of Defense in the Nuclear Age*, 3.

G. THESIS OVERVIEW

The goal of this thesis is to explain what enabled Singapore's remarkable achievement in modernizing its armed forces. In line with that goal, this thesis is organized into five chapters. Chapter II provides the historical background and theory of strategic planning and innovation institutionalization; and an explanation of what factors possibly enabled Singapore Armed Forces' modernization. Chapter III explains critiques or pitfalls of planning and strategic planning. Chapter IV explains the significance of the Singapore Armed Forces' innovation institutionalization in enabling its modernization. Finally, Chapter V provides summary, conclusion, and possible future research related to the Singapore Armed Forces' modernization.

II. LITERATURE REVIEW

There are only a few studies which attempt to explain the Singapore Armed Forces modernization. Therefore, this research draws upon literature in a number of fields, including various support resources, official publications and documents, books, speeches, articles, journals, and other materials to provide knowledge about how a defense organization conducts its operations. First, the literature review examines the theoretical explanation of defense planning. Second, we examine literature on strategic planning, including its advantages and disadvantages. Finally, the last section discusses literature on innovation institutionalization, which provides another set of systematic tools with which to assess Singapore's military modernization.

A. THEORY OF DEFENSE PLANNING AS RISK MANAGEMENT

Many variables must be considered regarding how an organization balances between preparing to face its future challenges and maintaining daily operations, as must a country in overcoming its strategic risks in balancing foreign policy and maintaining national security. This situation arises because of the nature of countries, which always assess their relations with other countries, enemies, allies, and even neighboring countries. Therefore, as an organization, will countries begin to identify how their perspectives are in handling certain problems or even future disputes? What circumstances can bring them into conflict, in the end, and how do they protect their interests? When a country starts to find out what military capability is needed and how to get it, that is when management methods are needed: defense planning.

As Frederic Taylor argues, planning is one of the best organizational scientific approaches to management.[54] He also proposes that productivity will increase if the manager optimizes and simplifies the working process. Therefore, he presented four basic reasons for why an organization should conduct planning. First, organizations should plan to coordinate activities. Second, organizations need to ensure that the future is taken into

[54] Henry Mintzberg, *The Rise and Fall of Strategic Planning: Reconceiving Roles for Planning, Plans, Planners* (New York: Free Press, 1994), 16.

account. Third, organizations should be rational in conducting their businesses. Last, a plan is required to control organization operations.

Planning should be performed in every step that an organization will take. A good plan should cover the required activities to achieve the desired goals. Planning should include the worst scenario to prevent any losses in the future. Hence, many organizations have more than one plan for every goal. Any possible future regarding the internal and external factors of the organizations' growth such as the employees and the consumers should be accounted for to calculate whether the organization's performance can meet their demands. All in all, planning is conducted to control how well the organization is being run. The better a plan is developed, the better the organization can perform.

In terms of defense planning, the U.S. Department of Defense (DOD) employs a planning process since it designs how big the structure and posture of its military forces must be as well as setting the readiness level.[55] Therefore, a rational mechanism is used by generating the defense requirements, which is divided into two basic methodologies of planning: demand- and supply-based planning. Prior planning tends to be demand-based, in which the strategies, capabilities and capacities needed to be set are based on the ideas of the need for the potential future engagement. Hence, demand-based planning considers the possible threats or the desired capabilities, even the combination of the two. This planning relates to the high-level of strategy to forecast the requirements needed in the future in line with the objectives that need to be accomplished,[56] which is called top-down planning.

In contrast, supply-based planning engages with a particular real-world constraint including the current size of the force, the mix of capabilities and budget limits, as well as the availability of forces built from the baseline. This planning is called bottom-up planning

[55] Michael J. Mazarr, Katharina Ley Best, Burgess Laird, Eric V. Larson, Michael E. Linick, Dan Madden, *The U.S. Department of Defense's Planning Process: Components and Challenges*, (Santa Monica: RAND Corporation, 2019), ix.

[56] Mazarr, Best, Lairs, Larson, Linick, and Madden, *The U.S. Department of Defense's Planning Process*," x.

which starts from the existing lower level, capabilities and resources, and builds up to the current force.[57]

When there is a gap between demand- and supply-based planning, there will be potential risk arising such as the effect of a resource-driven force, which is less capable in some ways than what would be prescribed by the top-down approach. Thus, the planning will not achieve its success unless it has the appropriate capabilities, capacity, and risk.[58] Therefore, a good strategic risk assessment should be conducted to deal with any possible liabilities in the future.

As Stephan Fruhling states, "once strategic risk is assessed, it must be related to the basic questions of defense planning outlines: its likelihood, consequences, material and political aspects, and associated uncertainties must be evaluated and managed."[59] He also outlines four defense planning frameworks that discuss various kinds of strategic risks:

1. Net assessment-based planning to meet the risk of conflict in the present and near future, with one known and understood adversary;
2. Mobilization planning to meet the risk of conflict in the future, at an uncertain time and from a threat that is yet to develop;
3. Portfolio planning, where the defence force must be able to configure itself to meet several different risks, and concurrency judgements are of central importance; and
4. Task-based planning, where uncertainty about the circumstances in which the defence force might be used is so great that planning has to focus on the ability to conduct basic military tasks.[60]

The application of a defense planning framework must be based on predictions, current assessments, and assessments of future challenges from a political perspective, followed by setting priorities. Similarly, analytical, planning, and programming efforts should be done during the development of the planning in order to determine the force posture required by a particular country. Most developed countries, which are serious about

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[57] Mazarr, Best, Lairs, Larson, Linick & Madden, x.

[58] Mazarr, Best, Lairs, Larson, Linick & Madden, xi.

[59] Stephan Frühling, *Defence Planning and Uncertainty: Preparing for the Next Asia-Pacific War* (London; Routledge/Taylor & Francis Group, 2014), 3.

[60] Frühling, *Defence Planning and Uncertainty,* 3.

implementing foreign policy, draw up a documented defense planning framework, together with assessments and future challenges they expect to manage. This document also includes general and detailed national defense reviews, which also include a summary of the framework that guides defense planning decisions; this document is better known as a defense white paper. Since modern militarized countries, mostly Western, publish this document regularly, many countries follow their path.[61]

The framework is applicable to various types of defense organizations in many countries. However, there are other approaches regarding defense planning since there is a need for improving planning not only based on the prediction and possible future challenges but also the requirement for an efficient process from more complex organizations. Therefore, as shown in Table 3, Henry C. Bartlett et al., identify nine different alternative defense planning approaches: *Top-Down, Bottom-Up, Scenario, Threats and Vulnerabilities, Core Competencies and Missions, Capability-Based, Hedging, Technology, and Fiscal*.[62] These approaches have their drivers, strengths, and weaknesses.

[61] Frederick W. Taylor, *Scientific Management*, (Harper & Row, 1947), 4.

[62] Henry C. Bartlett, Paul G. Holman Jr, and Timothy E. Somes, "The Art of Strategy and Force Planning," In *Strategy and Force Planning*, ed. by Security, Strategy, and Forces, Faculty (Newport, RI: Naval War College Press, 2004), 17–33.

Table 3. Summary of Alternative Approaches to Defense Planning[63]

Approaches	"Drivers"	Strengths	Pitfalls
Top-Down	Interests Objectives Strategies	Systematic focus on ends Integrates tools of power Descriptors lend focus	Constraints considered later Possibly Inflexible Lack of detail about executability
Bottom-Up	Existing capability	Practical current focus Emphasizes real world Improves existing forces	Present emphasized over future Neglects long-term creativity Neglects integrated global view
Scenario	Specific situations	Tangible focus Encourages priorities Dynamic—treat time well	World unpredictable May take on "a life of its own" Limited insights on a longer timeline
Threats and Vulnerabilities	Risk Adversaries Own weak points	Focus on potential adversaries Both broad and specific focus Emphasizes force capabilities	Identification contentious Reactive Biased toward quantitative data
Core Competencies and Mission	Functions	Prioritizes core capabilities Maximizes strengths Exploits weaknesses of others	May retain outdated capabilities May ignore higher-level goals Tends toward sub-optimization
Capability-Based	Operational challenge	Specific focus on the military problem Focus on operational concepts and joint capabilities Joint focus	Overemphasize on current challenges Determines desired mix but not level of forces
Hedging	Minimize risk	Full spectrum of capability	Understates own strengths

[63] Bartlett et al., "The Art of Strategy and Force Planning, 31.

Approaches	"Drivers"	Strengths	Pitfalls
		Confronts uncertain future Seeks balance and flexibility	Exaggerates others' capabilities Very costly
Technology	Dominant systems	Stresses knowledge Encourages creativity Creates military leverage	Risk high cost for a small gain May undervalue human factors May unbalance force structure
Fiscal	Budget	Defense linked to the economy Requires priority setting Fosters fiscal discipline	May lead to underfunded needs Tends to create cyclic spending Leads to "fair sharing"

Bartlett et al., define planning based on the strengths and possible pitfalls or drawbacks of each approach. The first alternative, "top-down," suggests that planning is driven by the interest, objective, and strategies that exist in an organization. It also proposed that the approach's strength pertains to the goal or objective of the organization; thus, planning focuses on the aim that the organization wants to achieve. It also utilizes any tools of power owned by the organization; therefore, the more the approach is described, the more systematic the goal achievement efforts will be. However, this approach also provides drawbacks such as facing future constraints, inflexibility and lack of detail, for it can be too focused on achieving the goals while overlooking any little details that may constrain its path in the future.

The second approach, "bottom-up," uses existing capability to its limit to achieve its goal. This approach will plan the defense by using current capability as the foundation. It takes every single detail into account. Therefore, it emphasizes the real world and improves the existing force. However, even though it is well planned, it still lacks future prediction, so it is likely to neglect long-term creativity since it focuses on current issues as well as neglecting the integrated global view.

The third approach is “scenario” based. Here, the approach considers a specific situation as the basic establishment of planning. Therefore, the strength of this approach is that it has tangible focus because the planning will calculate the steps to be taken in reaching the goal as well as the possible issues that will be faced in the future. Unfortunately, this approach also allows risks to arise, such as the possibility that there will be an unpredictable world. Since this approach only focuses on their scenario, it may be vulnerable to other intervening factors to be neglected. Similarly, it also limits the future insight and may take on “a life of its own.”

The fourth approach is “threats and vulnerabilities.” This approach uses any possible risks, adversaries, and the organization’s weak points for defense planning. This approach’s strength lays in the focus on potential adversaries, broad and specific aims, and the force’s capabilities. This approach focuses on any possible risk factors both internal and external. However, it still has pitfalls, such as the identification process which may take too much time because it needs to be discussed thoroughly. It is also reactive and biased toward quantitative data.

Therefore, Bartlett et al., propose the fifth approach, based on “core competencies and mission” which is driven by the desired planning future functions. It brings benefits such as the ability to prioritize core capabilities so that the organization can utilize its capabilities as efficiently as possible to reach their goal. Besides, this approach also maximizes strengths and exploit others’ weaknesses. In other words, this approach leverages the force’s capabilities to defend against the others’ threats. However, practically, this approach usually retains outdated capabilities since the organization is already satisfied with its current power and then it may cause the organization to ignore the higher goals since it is in their safe zone. These will lead the organization toward sub-optimization.

The sixth approach is “capability-based,” which is driven by operational challenges. This approach specifically focuses on the military problem and concept of operational and the force’s joint capabilities; hence, this approach emphasizes joint capabilities. However, this approach fails to determine the level of required forces for it neglects the possibility of future challenges.

In contrast, the seventh approach, "hedging," appears as its solution; its driver is risk minimization. The hedging approach benefits from the spectrum of the force's capability and utilizes it for its best application. This approach also may confront an uncertain future preventing the organization from being overwhelmed by any potential solutions when an unpredicted attack comes. Furthermore, it seeks balance and flexibility so that the organization can take any steps required when facing the future incident. Even though this approach is needed, it still has risks, such as that it may understate its own strengths, exaggerate other's capabilities, and can be very costly. The risks appear when the plan has too much prediction and preparation so that the cost is getting higher, as there is no perfect forecasting.

The last two approaches are "technology" and "fiscal." The former emphasizes the knowledge mastered by the forces and engages creativity to develop military leverage. The pitfalls of this approach come from risking high cost only to gain a small amount of achievement since there is no cheap technology in this century. Then, it may undervalue human factors, since technology is preferable, because it is considered easier to control than human. This undervaluing action may imbalance the force's structure. Next, the last approach that needs to be considered is fiscal. This approach helps bridge the economists and the military forces, since the military organization does not operate in the same way as the private company, which seeks profit. Thus, the planning of defense will be connected to the budget planning.

The ten alternative approaches to defense planning by Bartlett et al., provides various approaches in defense planning complete with the strengths and weaknesses of each approach. Therefore, this research discusses the application of these principles during the process of Singapore military modernization, by providing the background of the current force situation and categorizing Singapore's approach based on the alternative defense planning approaches.

B. THEORY OF STRATEGIC PLANNING

Understanding the source or nature of Singapore's successful military modernization requires a framework for evaluating Singapore's military modernization

and the literature on strategic planning provides such a framework. Therefore, an understanding of the definition of strategic planning is crucial added up with the understanding of its virtues as well as pitfalls and fallacies.

In *The Rise and Fall of Strategic Planning*, Henry Mintzberg concludes that *planning* is future thinking, an effort to control the future; planning also involves the process of decision-making, or even synchronizing the minds of the nowadays-decision-makers, and finally, as Mintzberg argues, it is also "a formalized procedure to produce an articulated result in the form of an integrated system of decisions."[64] With respect to the *strategic* part of strategic planning, he also argues that strategy is a plan and a pattern. Strategy as a plan means that it is something equivalent to a direction, guide, or a course of action to get from one point to the desired point; some planners call it an end goal. Strategy as a pattern is reflected in behavioral consistency over time while taking future dynamics into account. Again, according to Mintzberg, together, strategic planning is the process of strategy formation; it involves the "planning process, designed or supported by planners, plans to produce plans."[65] Overall, Mintzberg concluded that all these terms can work together or be independent of each other.

How does this process of strategic planning take place? Mintzberg states that there is a formalization of the process of strategy formation, called the SWOT model, which stands for strengths, and weaknesses, opportunities, and threats.[66] The SWOT model process involves an initial appraisal, both internally and externally, which assesses many variables: the creation of the strategy or planning the strategy, where planners may come with different approaches; formalization of the strategy; evaluation of the best one; and finally, the process of strategy implementation. Mintzberg summarizes this process through a model called the "Design School" model of strategy formation, based on the premise that strategy formulation is a conceptual process of designing strategies (Figure 3). Mintzberg

64 Mintzberg, *The Rise and Fall of Strategic Planning*, 14.

65 Mintzberg, 32.

66 Pmp Pritchard, "SWOT Analysis." In *Risk Management: Concepts and Guidance*, Fifth Edition, 183–90 (Auerbach Publications, 2015), 151. https://doi.org/10.1201/9780429438967-24.

also emphasizes that some other scholars did not even call “Design School” a model due to the vast dynamics in the real world.

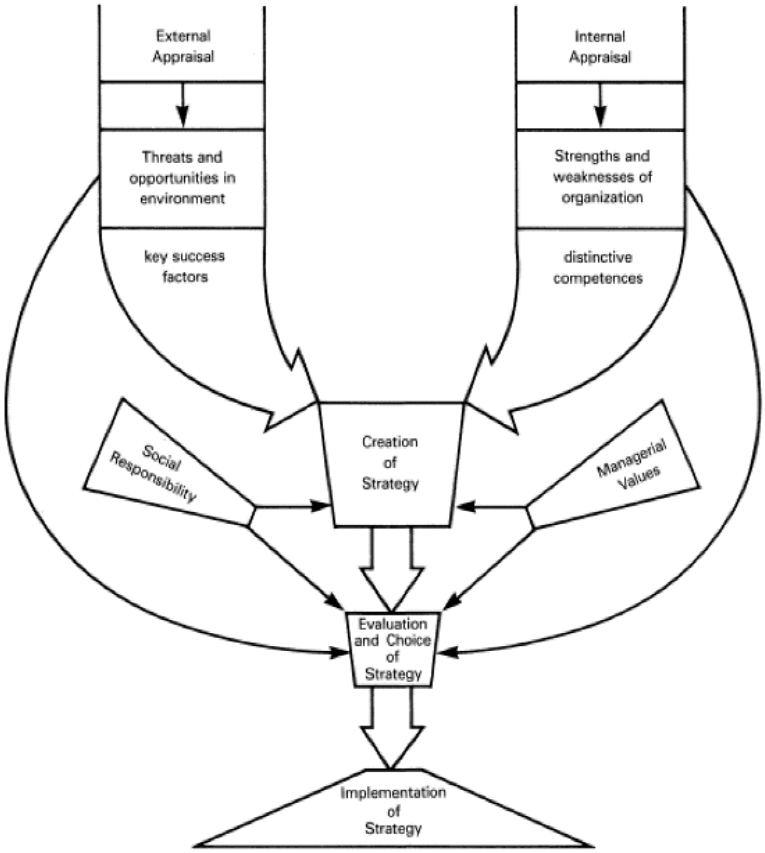

Figure 3. Core “Design School” Model of Strategy Formation[67]

Planning literature demonstrates that a well-designed system or method more consistently increases the chance of organizational success compared to human factors, such as intuition and commitment,[68] as planners believe that human factors are unreliable, whereas systematic methods and strategic planning are more reliable.[69] Deepak Kukreja points out that it is better to be approximately right, helped by the systematic method, than

[67] Mintzberg, *The Rise and Fall of Strategic Planning*, 37.

[68] Mintzberg, 222.

[69] Mintzberg, 223.

to be precisely wrong,[70] referring to how, theoretically, a systematic method could provide a clear direction, as well as efficient and effective measures towards success, compared to pursuing unclear goals relying on human intuition and commitment. Lastly, Michael Porter also emphasizes the importance of strategic planning: "As firms [organizations] grew and became more complex…they needed a systematic approach to setting strategy. Strategic planning emerged as the answer."[71] Therefore, strategic planning could have increased the capability of the Republic of Singapore, a complex organization, to operate more efficiently toward achieving its predefined goal, a modern SAF.

However, Mintzberg also argues against the conventional wisdom which favors strategic planning.[72] He argues that there are several crucial pitfalls and fallacies in planning and strategic planning implementation. As he points out, there are four pitfalls to the planning practices. First, the top management's participation in and support of planning will not ensure the achievement of the desired end goal. Second, all types of plans are vulnerable to any changes and dynamics in their implementation. In fact, the more advanced and established a plan, the more inflexible the administration becomes; the more detailed and institutionally widespread the plan, the greater the inflexibility.[73] Third, political activity may interfere with the planning process, an exercise of interest competition. Fourth, the plan tends to control everyone and everything, due to a flaw in the planning process, that all components should manifest it collectively, not individually.[74]

Likewise, according to Mintzberg, the fallacies of strategic planning are: First, the assumption that discontinuities can be predicated. Second, planners are separated from the reality of every organization. The third is the assumption that strategy making can be

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[70] Deepak Kukreja. "Strategic Planning: A Roadmap to Success." *Ivey Business Journal* (Online), September 1, 2013, N_A. http://search.proquest.com/docview/1441621850/.

[71] Michael Porter, "Corporate Strategy: The State of Strategic Thinking." *The Economist* 303, no. 7499 (May 23, 1987): 17. http://search.proquest.com/docview/224209770/.

[72] Mintzberg, *The Rise and Fall of Strategic Planning,* 221.

[73] Mintzberg, 173.

[74] Mintzberg, 210.

formalized.[75] Another scholar, Aaron Wildasvsky, claims in his planning criticism that in its effort to regulate everything, planning could end up regulating nothing:

> - Planning protrudes in so many directions, the planner can no longer discern its shape. He may be the economist, political scientist, sociologist, architect or [even] scientist. Yet the essence of his calling-planning-escapes him. He finds it everywhere in general and nowhere in particular. Why is planning so elusive?[76]

Moreover, there is also a concern of the contractual nature of strategic planning.[77] Allaire and Firsirotu proposed that the contractual nature of strategic planning provides some functional modes of planning in which each mode needs particular requirements to be successful.

The strategic plan, as a contract, defines all the potential pitfalls of the principal-agent relationship.[78] Therefore, a system should be managed to prevent the pitfalls so that the organization can monitor and reward the agents to maximize the benefits. The system should be able to measure the issues within the organization; thus, Allaire and Firsirotu claim that there are two sets of measures—structural and cultural—to deal with the possible risks and problems in the organization.

The structural approach is heavily influenced by economic theory and claims that both the principal and the agents have self-interest in maximizing their economic benefits, which also tends to minimize costs. In the end, this system will entail the adoption of an appropriate organizational form and an effective control/inducement apparatus to protect the organization from opportunistic behavior. Therefore, the solution is to divide the organization into units of a moderate and manageable size, as well as having a clear market purpose. The other step is to assign both responsibility and accountability of each unit to competent managers who operate with an external control system (including a highly competitive product markets and an efficient financial market, as well as a tight

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[75] Mintzberg, 227, 254, 294.

[76] Mintzberg, *The Rise and Fall of Strategic Planning*, 6.

[77] Yvan Allaire and Mihaela Firsirotu, "Strategic Plans as Contracts," *Long Range Planning* 23, no. 1 (February 1, 1990): 102–15, https://doi.org/10.1016/0024-6301(90)90012-S.

[78] Allaire and Firsirotu, "Strategic Plans as Contracts," 103.

organization monitoring) and reward (including the complex structure of salaries based on the employee's capabilities and function, bonus, stock options etc.).[79]

In contrast, the cultural solution toward the corporate's issues proposes that the shared values, goals and experience have a significant effect in reducing the cost of self-serving behavior. It points out that the organization should have a set of core skills to invest at, in order to familiarize the members toward a common set of values, benefits and management principles. This is also useful for defining a long-term relationship between the individual and the organization. Regarding this solution, a limitation of the diversity of business should be taken into account in every firm since it depends upon the same set of critical skills. In other words, when the corporation produces too much variety of product, technology and success factors will make it impossible to establish a cohesive and encompassing culture for the entire organization, for they lack the principal identity.[80]

However, to deal with the possible risks and problems in the organization, neither the structural nor cultural solution is cost-free. Besides, the degree of emphasize on each solution is often a matter of choice regarding the issues that occur in the firm or organization. However, once made, these choices—whether to utilize the structural or cultural, or even the combination of the two—are very hard to reverse.[81]

These critiques, with regard to the pitfalls and fallacies of strategic planning, raise significant questions about how Singapore overcame these issues and still managed to achieve its desired end goal, or even whether it used strategic planning at all.

This subchapter has provided theoretical explanations of what is strategic planning, what are its superiorities as well as its flaws and fallacies. During the implementation of strategic planning, every organization or administration has to deal with a wide array of variables during the preliminary appraisal, end goal prioritization, strategy formulation, and implementation. Although strategic planning helps an organization understand its position and future direction, the only certainty of future challenges is the uncertainty.

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[79] Allaire and Firsirotu, 103.

[80] Allaire and Firsirotu, 103–104.

[81] Allaire and Firsirotu, 104

Therefore, organizations have to deal with strategic planning's flaws and fallacies, too, such as top management involvement not being a guarantee of success, vulnerability toward changes, political interference, and its inflexibility.

C. INNOVATION INSTITUTIONALIZATION

Analyzing Singapore's military modernization from an alternative perspective—innovation institutionalization—requires an understanding of the characteristics of this method. As stated by Scott D. Anthony et al., innovation institutionalization is an effort to build "an engine that produces a steady stream of innovative growth."[82] They also argue that "companies that create blueprints for growth, construct innovation engines and support the engines with the right systems and mind-sets can establish favorable conditions for substantial innovation."[83] The capability of an organization to build and maintain innovation institutionalization could significantly differentiate the organization from its competitors.

These scholars argue that for an organization to create a growth blueprint, a guide and direction that articulates the desired outcomes, and to decide which strategies are good—or bad—the organization will have to deal with uncertain and endless innovation competition. It also identifies and explains the desired results or goals of the organization's innovation efforts and where growth and development must be expected. In general, growth and expansion come from organizational efforts that enhance the core business, move to adjacent markets, or go to uncharted seas by creating totally new businesses. More important, commonly easy-to-understand insights, generated from the blueprint, help clarify the picture of the challenges of innovation and make it easier for managers to understand the characteristics of different approaches, which lead to the whole organization efficiently and effectively deciding which strategies or approaches should be taken to achieve the objectives. Because resources are limited, organizations, ideally, must allocate

[82] Scott D. Anthony, Mark W. Johnson, and Joseph V. Sinfield, "Institutionalizing Innovation," *MIT Sloan Management Review*; Cambridge 49, no. 2 (Winter 2008): 45.

[83] Anthony, Johnson, and Sinfield, "Institutionalizing Innovation," 45.

their possessed resources toward the different types of effort or innovation, appropriately. Otherwise, they will only bankrupt themselves.

The next step is to construct an innovation engine. As it is hard for new growth initiatives to succeed without structural support and there is no one-size-fits-all way to structure for innovation,[84] Anthony et al., argue that there are four different structures to consider, as shown in Figure 4.

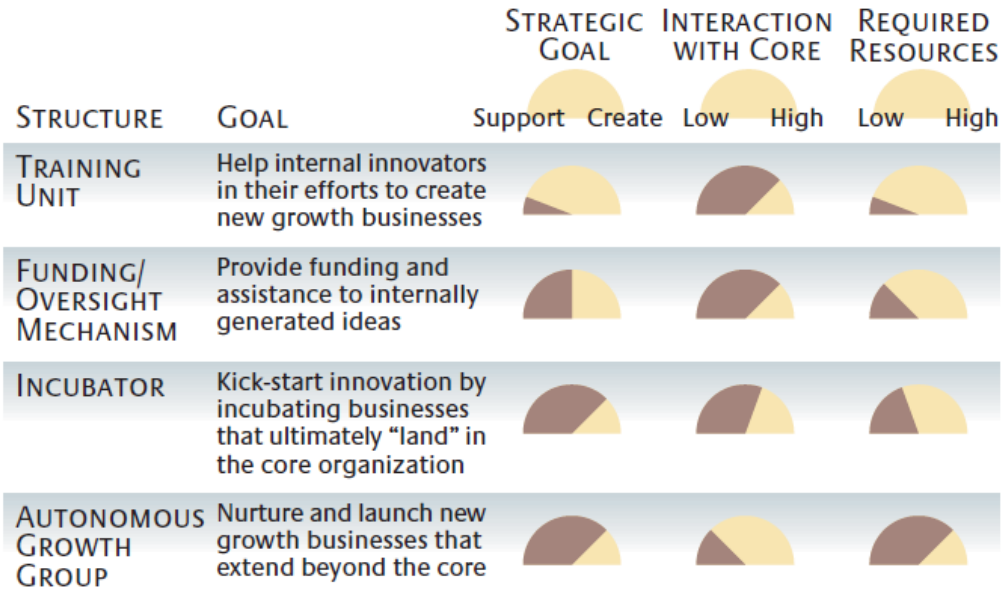

Figure 4. Structure of Innovation.[85]

Based on the structure of innovation proposed by Anthony et al., the first structure is training the units within the organization. This structure aims to stimulate the innovation. As the foundation of the structure, training requires the organization to build disruption-specific skills and culture focusing on building the skills and changing the mindset of core personnel in order to fuel internal innovation. The effort of developing a new mindset will help the organization in solving its practical innovation problems because it allows the

[84] Anthony, Johnson, and Sinfield, 48.

[85] Anthony, Johnson, and Sinfield, 49.

personnel or even the boards to gain exposure to important external developments. Therefore, training can be gained from outside the organization by conducting a joint venture with influential companies to maximize the potential benefits between the organizations.

The second structure is funding or oversight mechanisms. This structure allows the company to shepherd or safeguard the innovation generated. The core problem of a firm can be the source of funding. Hence, generous funding may help the internal innovators who are immediately faced with a “stuck” because the lack of funding can be solved and then their innovative ideas are secured. This structure benefits the creative innovators to grow their ideas so that their ideas will not encounter limits, or cause worry or even anxiety about possible unsuccessful ideas in the future.

The third structure is incubators. This structure attempts to accelerate ideas when the funds gathered are still insufficient to generate ideas. A firm whose incubators are dedicated will gain many benefits for their ability to alter rough ideas into something bigger, better, cheaper and faster, in the blink of an eye. However, the organization may have to follow a process outside its constraints and priorities to allow the incubators to execute their ideas because they commonly work outside of the box.

The last structure is the autonomous growth group. This will expand the organization since it allows it to launch new and different kinds of businesses. These autonomous groups will help the company in developing non-core business concepts as well as exploring various concepts outside the core’s comfort zone. Having fully dedicated innovation generalists and other high-potential leaders will help them allocate a modest budget to quickly iterate solutions toward organizational success.

The effort to achieve goals will not endure unless organizations create a supportive climate or environment for the innovation to thrive. Therefore, an effort to maintain and support the innovation engine is crucial. Successful organizations must also have a managerial level that is actively involved in developing ideas and sharing the same language of innovation, which this engine is facilitating, as Anthony et al., argue, using

"substantial external input, and creating policies and incentives that encourage people to take managed risks on the path to innovative growth."[86]

Concomitantly, Michael Raynor and Clayton Christensen also characterize that instituting innovation is not an easy job. Some sizeable and complex organizations may also be utilizing the internal-customer concept, where internal departments serve as service provider to other departments in the same organization.[87] The service provider department tries to provide its best service by listening to its internal customers and dealing with, as characterized by Raynor and Christensen, a "painful choice between serving today's best internal customers and creating future best internal customers."[88] This situation would make the organization vulnerable to disruption, which inhibits its growth, called the "innovator's dilemma."[89] This phenomenon could be a serious issue during the implementation of innovation in large and complex organizations.[90]

Therefore, Alex Osterwalder invented a method to simplify the picturization of innovation efforts in describing, finding challenges, designing, and inventing suitable business model or models, known as the Osterwalder's Business Model Canvas. This chart could show the flexibility and method for simplifying innovation implementation, as shown in Figure 5.

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[86] Anthony, Johnson, and Sinfield, 50.

[87] Michael Raynor and Clayton Christensen, "The Innovator's Solution," *Optimize*, November 1, 2003, 65. http://search.proquest.com/docview/205223798/.

[88] Raynor and Christensen, "The Innovator's Solution," 65.

[89] Cited in Raynor and Christensen, 66.

[90] Raynor and Christensen, 65.

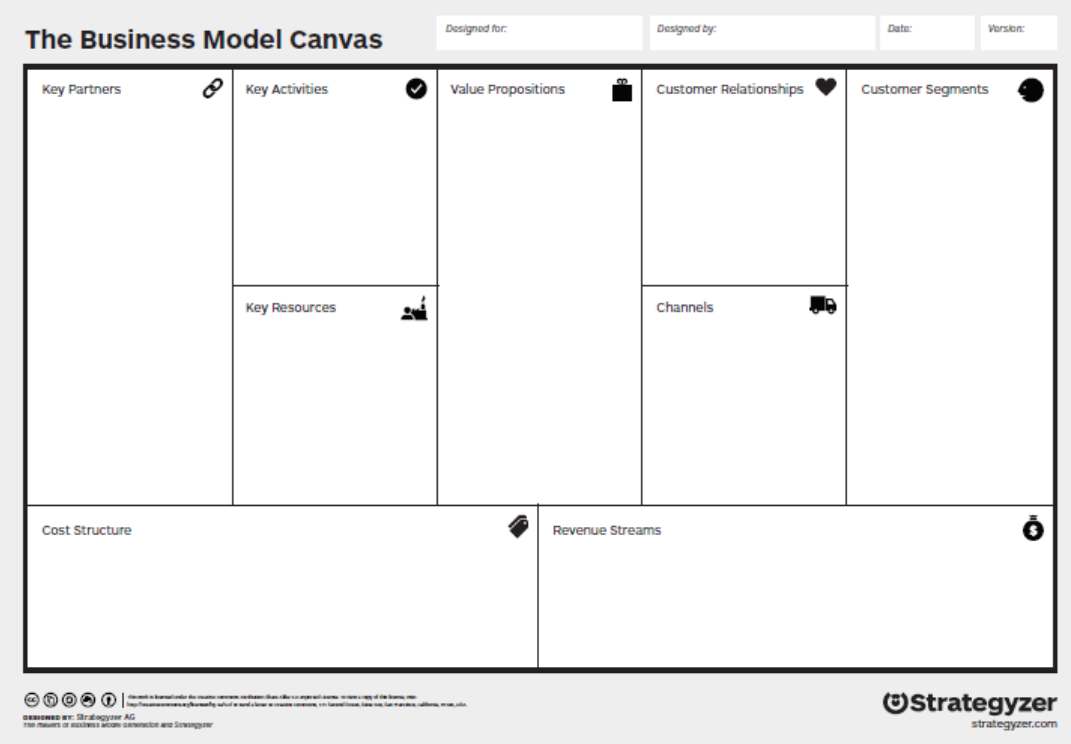

Figure 5. The Osterwalder Business Canvas[91]

The canvas is a kind of chart to describe, challenge, design, and invent any type of business model, even modify the existing model, systematically to serve the organization or corporation's goals and make them tangible. This business canvas consists of nine building blocks: customer segments, value propositions, channels, customer relations, revenue streams, key resources, key activities, key partners, and cost structure.[92] The first block, customer segments block, is a block that defines what kind of customer an organization is trying to serve. The second block, the value proposition, describes the value of the organization's products and services that serve the customers' needs or interests. The third block, the channel block, should tell the potential means of how customers reach the organization, and vice versa. The fourth block, customer relationships, provides a slot to

[91] Source: Staregyzer, "The-Business-Model-Canvas-1.Pdf," accessed March 11, 2020, https://www.strategyzer.com/canvas/business-model-canvas

[92] "Osterwalder explaining the Business Model Canvas in 6 minutes," November 17, Dazrene Darus 2015. https://www.youtube.com/watch?v=RpFiL-1TVLw

customize specific relationships to particular customers or segments; this block aims to maintain customer loyalty. The fifth block, revenue stream, describes the methods of how the customer contributes to the organization or company through various methods of payments or other means that benefit the organization. The sixth block, key resources, lists the significant resources the organization requires to produce value, which varies from raw material resources, factories, brands, or intellectual properties. The seventh block, key activity, covers what kind of crucial activities serve the organization's goals best, what the organization really needs to do to excel. The eighth block, key partners, list the important and potential partners that an organization should work with to achieve its goals or leverage its business. Lastly, after properly filling the first eight blocks, an organization should be able to determine its cost structure. Most simply, other than providing a clear picture and better understanding of a business concept, this chart could also provide flexibility through something even as simple as the sticky note. It means that the innovator could simply map out the concept by replacing the idea, written on a sticky note, with a new one, without breaking the whole concept, when the idea no longer accommodates the organization's goals.

Creating the ability to produce a sustainable stream of innovative growth does not happen overnight. Organizations that have decided to institutionalize innovation as their approach must start by orienting their current position through auditing their innovation capabilities and developing plans to compensate for their identified weaknesses. In the next step, they must change the organizational culture and build new structures and systems that support innovation to thrive, which are not easy and become more complicated as the size of the organization grows. However, organizations which develop a shared perspective of their main goals, start to act, and are capable of making the necessary adjustments when they decide to prioritize what sector has the opportunity to succeed and what does not, are organizations with a better chance of succeeding.

This literature review has provided theoretical explanations of where the position of defense planning fits in risk management and how strategic planning differs from innovation institutionalization. Defense planning is a method of a military organization in managing its routine operations. Strategic planning is a method of strategic formation in

dealing with future challenges, which produces guidelines—what and how to do—based on a predicted, predefined, and prejudged future challenge, which mostly tends to behave like a contract, binding and inflexible, due to the tendency of strategic planning users to formalize their plans. On the other hand, innovation institutionalization produces an engine that nurtures innovation in order to deal with future challenges, prepared to deal with the uncertainty of future challenges.

Overall, both strategic planning and innovation institutionalization are strategy formulation methods. The main distinction between the two methods are: strategic planning always predefining its future challenges and less flexibly due to its tendency to be formalized, while innovation institutionalization has nothing defining its future challenges, therefore, it becomes so flexible in addressing any challenges.

III. THE SAF MILITARY MODERNIZATION PROCESS

This chapter analyzes what approaches made Singapore's military modernization so successful. The analysis is organized according to the SAF evolutionary stages. The initial period (mid 1960s–1970s) heavily focused on recruiting and establishing the Singapore security and defense forces, assisted by Israel Defense Forces advisers. As characterized by Evan Laksmana, 1G SAF (1970s–1980s), "Poisonous Shrimp," concentrated on developing and building the capabilities of each service, while implementing then-visionary yet now conservative approaches. The 2G SAF (1980s–1990s), "Porcupine," was a period of consolidation and adaptation; during this period the SAF moved from strategic thinking on each service to a conventional combination of armed warfare, driven by the maturity of the SAF capabilities and domestic defense planning capacity. The 3G SAF (2000s–2030s), "Dolphin," aimed at applying the transition to a joint strategy to create a force posture with multi-mission capabilities,[93] and the 4G SAF (2030s onward)[94] is a well-debated and -researched concept of future SAF, based on cutting-edge technology as a force multiplier.

The analysis finds that Singapore Armed Forces' modernization not only involved replacing its hardware but also, more significantly, modernizing its software—conceptual, organizational, technological, and operational[95]—during all its evolution stages. During the early stages, Singapore implemented predefined situation-based development—strategic planning—assisted by Israeli military advisers and by their guidance documents, the "brown book" and the "blue book."[96] In the next stage, thanks to its heavy investment in training and education,[97] Singapore started to cultivate innovation through its military

[93] Laksmana, "Threats and Civil-Military Relations," 353–54. https://doi.org/10.1080/14751798.2017.1377369.

[94] Raska, *Military Innovation in Small States*, 157.

[95] Raska, 132.

[96] Raska, 139.

[97] Huxley, *Defending the Lion City*, 109.

personnel, academically, through monographs and journals,[98] which increased its modernization pace; backed by a nurturing culture of innovative ideas alongside SAF's regular, well-functioning bureaucracy. In the current stage, its modernization pace is barely challenged regionally, propelled by the remarkable thriving of innovation within the SAF, due to its establishment of dedicated organizations that act as innovation engines. Based on these findings, the early period of Singapore's military development showed a distinctive pattern that differentiated it from the rest. Ultimately the less flexible strategic planning method did help SAF modernization during its early period, then the flexible innovation institutionalization method started to take over gradually in the 1980s. In the 3G SAF, Singapore maintained its technological advancement thanks to innovation institutionalization. The combination of thriving innovation and Singapore's well-functioning bureaucracy refined through early-stage strategic planning kept SAF innovation productive rather than disruptive and inefficient.

A. SAF INITIAL PHASE (MID-1960s–1970s)

Although the term "strategic planning" was not yet widespread, Singapore was already employing the concept by identifying strengths and weaknesses, forecasting future goals and threats, and defining suitable approaches and guidelines. Using SWOT analysis, Singapore not only properly identified its strengths and weaknesses but also took its best opportunity in addressing its well-defined threats. First, Singapore had security benefits from the presence of British Forces, which it identified as its strength. Second, Singapore fairly and openly acknowledged its weaknesses: its deficiency of military experience and its natural constraints. Third, it addressed its deficiency by looking for opportunities, asking for foreign assistance to help build up its military forces. Last, Singapore defined how much military buildup was enough, by designing its military capability to maintain internal security and to defend its territory against its traditional threats, its immediate neighbors: Malaysia and Indonesia.

[98] Raska, *Military Innovation in Small States,* 148–49.

1. Threats

As described in Chapter I, Singapore's security perspective is heavily shaped by its geopolitical concern regarding its immediate neighbors, Indonesia and Malaysia, which significantly affects Singapore's internal stability. Therefore, Singapore identified its threats based on this context and formalized its threat assumptions as the main reason to develop its military posture.

Even though Singapore gained independence in 1965, and despite Singapore's constitutional secession from Malaysia, Malaysia maintained a security interest in the island. Malaysia did not hesitate to practice coercive diplomacy when it deemed Singapore's actions as unacceptable, and even insisted on stationing an infantry regiment in Singapore following its independence, in a demonstration of force.[99] This action compelled Singapore Prime Minister Lee Kuan Yew to allow Malaysian Army outriders to "escort" him to the first post-independence Parliament sitting. This threat was even tightened when Malaysia wanted to use its Navy to blockade an offshore island that would be used by Singapore as a barter trade zone with Indonesia, forcing Singapore to neglect the initiative. Another imminent Malaysian threat was the Singapore-Malaysia water agreement dispute. Despite the existence of the water agreement, Malaysian leaders often exploited Singapore's water dependency to apply political pressure, threatening to shut the water supply off if disagreement occurred.[100]

The next threat came from Indonesia, back then the dominant power in the region. Indonesia continued its *Konfrontasi* campaign by conducting sub-conventional warfare operations against Malaysia, which Singapore was part of, despite a negotiation for cessation of hostilities before Singapore's independence. The *Konfrontasi* ended in 1966 when General Suharto's Indonesian army-backed, conservative right-wing forces successfully wrestled power from the pro-left-wing Sukarno regime. However, still, in 1968 Indonesia posed a threat after Singapore hung two Indonesian soldiers, disguised as

[99] Toh Boon Kwan, Singapore's Development and Use of Military Power: Diplomacy, Detterence, Compellence and Counter-coercion (2016), 8.

[100] Kadir Mohamad, *Malaysia Singapore Fifty Years of Contentions* (The Other Press Sdn. Bhd. Selangor, 2015), 256.

civilian volunteers, for terrorism during the *Konfrontasi* campaign, when there was a potential of Indonesia to respond with military threats.

2. Weaknesses

Singapore, during this period, identified its two main deficiencies as lack of experience in the military realm and natural constraints. In terms of military capability and defense liability, the two Singapore Infantry Regiments (SIR) had many limitations and weaknesses: first, these units were commanded by British officers and were largely manned by Malaysians; second, these units were trained for defensive and internal security purposes, not for offensive and managerial purposes. The fact that most of the local military forces were led by British officers and manned by Malay Malays and Singaporean Malays caused a lack of military experience in the Singapore Chinese population. In general, therefore, Singapore had to build defense capacity from zero in almost every aspect, including defense planning, organizational power structures, doctrines, training, weapons procurement, and even culture.

Structural vulnerabilities included demographics, lack of strategic depth, lack of natural resources, and geopolitical and ethnic complexities.[101] First, Singapore had a demographic concern as it has a small population, and thus a shortage of manpower in maintaining its independence and securing national interests. Second, Singapore's small landmass and territorial waters gave the small island state a lack of strategic depth, meaning that all of Singapore's territory is the main point of interest that must be defended in any way. Third, Singapore's natural constraints first stem from the fact that Singapore lacks essential natural resources. Conversely, its neighboring countries possess extensive resources as their economic base, especially in the agrarian sector. Lastly, Singapore has to deal with geopolitical and ethnic complexities, with its predominately Chinese population frequently being persecuted by the predominated Muslim Malay immediate neighbors, Malaysia and Indonesia.

101 Huxley, *Defending the Lion City*, 31–32.

3. Strengths

Following independence, Singapore experienced good economic performance, and it still served as a major British military base.[102] Over the latter half of the 1960s and early 1970s, Singapore experienced high economic growth, even reaching double digits continuously from 1966–73, thanks to its geostrategic position, its efficient entrepôt service, and its investment-friendly policies. Despite the interrupted economic activity caused by its confrontation with Soekarno's administration from 1963–66, Singapore rapidly stood on its feet and steamed up its economy. Singapore continued its industrialization efforts by setting up more spaces as industrial estates and promoting foreign investment through friendly policies, efficient infrastructure, and financial incentives.[103] As a small island-city state, Singapore's economic growth developed remarkably, as shown in Table 4.

Table 4. Singapore's Economic Growth 1962–1973[104]

Year	GDP ($US)	GDP Per Capita	Growth Rate
1962	$0.83B	$472	7.55%
1963	$0.92B	$511	10.04%
1964	$0.89B	$486	-3.10%
1965	$0.97B	$517	7.83%
1966	$1.10B	$567	10.18%
1967	$1.24B	$626	12.51%
1968	$1.43B	$709	13.53%
1969	$1.66B	$813	13.83%
1970	$1.92B	$926	13.94%
1971	$2.26B	$1,071	12.41%
1972	$2.72B	$1,264	13.32%
1973	$3.70B	$1,685	10.60%

[102] Murfett, *Between Two Oceans*, 298.

[103] Milne and Mauzy, *The Legacy of Lee Kuan Yew*, 133.

[104] Source: Macrotrends, "Singapore GDP 1960–2020," accessed February 18, 2020, https://www.macrotrends.net/countries/SGP/singapore/gdp-gross-domestic-product.

Another of Singapore's strengths during the initial phase was that, from 1965–68, its de facto external defense was still carried out by the British military, which still maintained its presence in its far east territory. As described by Tim Huxley, in the 1960s, "Singapore was hardly defenseless against external threats, given not only the close defense relationship with Malaysia, but also the massive British military presence."[105] Due to this extensive British military presence, Singapore was described as the "Garrison Island," and there was no single aspect of Singaporean life untouched by the British forces' presence. In fact, in this period, British military forces' presence contributed to 25% of Singapore's gross domestic product (GDP).[106] The British stationed in the country its first-line combat aircraft, aircraft carriers, major naval combatants, as well as a submarine squadron. All these forces were supported with modern military facilities, from housings, logistics, workshops, training, and the most modern air defense systems.[107] In addition, there were also Singapore's local defense and security forces, consisting of two organic infantry regiments, the SIR; the Singapore Naval Volunteer Force (SNVF), a small coastal patrol force; the Singapore Division of the Malayan Royal Naval Volunteer Reserve (RMNVR); and the police force.[108]

4. Opportunities

After assessing its threats, strengths, and weaknesses, Singapore identified its opportunities, available courses of action. One opportunity was to maintain reliance on the presence of British forces to maintain security. This option was rational for a small ex-British colony like Singapore, which could benefit from the British military experience with all defense investment liabilities falling on the British. However, due to the British forces' reduction and withdrawal plan, this option was not viable in the long term.

In addition, Singapore explored the possibility of utilizing its commonwealth connection in order to compensate its deficiencies. This option had the same advantages as

[105] Huxley, *Defending the Lion City*, 8.

[106] Murfett, *Between Two Oceans* 301.

[107] Murfett, 300–301.

[108] Huxley, *Defending the Lion City*, 5–6.

the previous one, Singapore's small contribution of defense liabilities, since British forces would still be in charge. However, the participation of Malaysia made this option less viable for Singapore, as Malaysia was Singapore's most likely adversary.[109] Moreover, Singapore also experienced a bitter lesson from the British inability to mediate the conflict during Singapore's expulsion from Malaysia in 1965.

Another opportunity Singapore identified was self-reliance. This option would allow Singapore to develop a force posture designed to address any regional threats independently, disregarding its constraints and unfavorable circumstances. It seemed more viable compared to the first two options. However, this option would require experience in the defense realm, which Singapore lacked, and a huge investment in acquiring modern defense systems.

5. Singapore's Initial Phase Strategic Planning Actions

Singapore finally elected the self-reliance option and developed its strategic planning. The essence of Singapore's initial phase strategic planning was the setting of a predefined security situation and future challenges, threats, and also the formalization of Singapore's steps and plans to address the predefined security situation and future challenges.

After Singapore conducted an initial assessment of its strengths and deficiencies, it looked for opportunities by seeking foreign assistance to help build up its military forces. Based on the idea that Singapore has to be able to defend itself, Lee Kuan Yew said that "in a world where the big fish eat small fish and the small fish eat shrimps, Singapore must become a poisonous shrimp." This metaphor became the character of Singapore's military forces' early development and staked out the start of its indigenous military forces' development direction. Dr. Goh Keng Swee, Singapore's first finance minister, led the effort to develop Singapore's military forces. Dr. Goh had his only military experience as

[109] Huxley, 44.

a corporal in the British-led Singapore Volunteer Corps until it surrendered to the Japanese Colonial in 1942.[110]

Recognizing his deficiency—lack of knowledge in military matters—Dr. Goh sought "good advice," as he did with Singapore's economy.[111] The decision to seek "good advice" was seen as a crucial step in the process of Singapore's military development. Singapore turned to Israel, which wanted to be helpful to this newborn island-city state. At that time, both Prime Minister Lee Kuan Yew and Defense Minister Goh Keng Swee believed that Israel, which resembled Singapore as a small country surrounded by Muslim countries considered threats, and with the Israeli Defense Forces' (IDF) well-known capability, could help Singapore to build its armed forces. After the withdrawal of British military forces that increased Singapore's vulnerabilities, the Singapore leadership claimed that "In the view of the PAP leadership, dominated intellectually and politically by Lee Kuan Yew, an independent Singapore could ultimately find itself in a geopolitically uncomfortable position, similar to that of Israel."[112] His declaration attracted the Israelis, who agreed to help Singapore's military by assigning its military advisers. In October 1965, they sent a high-ranking Israeli officer to assist Singapore in building up its military forces.[113] The officer met Dr. Goh under great secrecy in order to avoid negative reactions from Singapore's immediate neighbors.

Singapore brought in the first wave of undercover Israeli military advisors in November 1965, who provided advice, training, doctrinal understanding, and guidance in the formation and initial development of Singapore's military capabilities.[114] The formation of Singapore's defense forces was adapted, assisted, and advised, hands-on, by the IDF in the areas of recruitment and training, management capacity, and organizational

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110 Lee Kuan Yew, *From Third World to First: The Singapore Story, 1965–2000* (New York: Harper Collins Publishers, 2000), 30.

111 Mattia Tomba, *Beating the Odds Together: 50 Years of Singapore-Israel Ties* (Singapore: World Scientific Publishing Co. Pte Ltd, 2020), 38.

112 Huxley, *Defending the Lion City*, 2.

113 Tomba, *Beating the Odds Together*, 39.

114 Tomba, 39.

and operational capabilities, through defense documents called the "*Brown Book*" and the "*Blue Book*."[115] The *Brown Book* was an Israeli document of a masterplan for the build-up of Singapore Armed Forces, created by an Israeli team of military advisers.[116] This *Brown Book* was a document covering a broad scope of military strategy and doctrine. It contained a basic assessment of the influencing variables and the main solutions in building Singapore's military strength, by building a popular army of conscripts trained and led by small regular soldiers. Therefore, this book also proposed to establish an "Officer Training School" to educate professional officers. From conscription, a people's army would become the backbone of the regular army of Singapore so that the entire country could be mobilized in case of emergency. This *Brown Book* also included the details of the phasing and implementation of the concept master plan. This document continued with the next document, the *Blue Book*, which sought to establish the ministry of defense and intelligence services.[117] At the same time, October 1965, Singapore established the Ministry of Internal Affairs and Defense (MID), with Dr. Goh Keng Swee as the first minister in position, who was previously Singapore's finance minister.

Based on Israeli advice, Singapore implemented what is now recognized as strategic planning. Its approach of formalizing and predefining Singapore's future threats was guided by the Israeli documents, designed for building Singapore's defense forces. The resulting 1966 Defence Plan envisioned the army's ambitious expansion, which would be achieved in a decade through conscription.[118] In February 1966, this initial step was followed by the establishment of the Singapore Armed Forces Training Institute (SAFTI), formed to train Singapore's military personnel, both non-commissioned officers and officers. Singapore predefined and formalized its future threats and plans in its confidential Defence Plan, which was finalized by September 1966. This plan mainly envisaged the

115 Tomba, 39–41.

116 Tomba, 39.

117 Tomba, 41.

118 Huxley, *Defending the Lion City*, 11.

Singapore army expansion of twelve battalions in ten years.[119] Singapore kept it secret until the detail was revealed two years later by the *New York Times*, as shown on Figure 6.

Singapore Plans a Big Build-Up Of Military Force Over 10 Years
New York Times (1923-Current file): Dec 4, 1968; ProQuest Historical Newspapers: The New York Times
pg. 16

Singapore Plans a Big Build-Up Of Military Force Over 10 Years

SINGAPORE, Dec. 3 (Reuters) —A big build-up of Singapore's military strength during the next 10 years was outlined today in a budget speech to Parliament by Finance Minister Goh Keng Swee.

Two infantry brigades and an armored unit will be raised by 1971, when the British military withdrawal is scheduled to be completed.

Dr. Goh said the annual cost could reach some 10 per cent of Singapore's current gross national product. This now stands at about 300 million Singapore dollars ($96-million).

In 10 years Singapore would have 45,000 trained soldiers under the plan.

"This is a substantial force by any standard—it should be adequate to protect Singapore against any foreseeable military threat," Dr. Goh added.

Defense plans for raising an armored unit of tanks and armored cars are at an advanced stage, he said. Officers and technicians for the unit are being trained at an Israeli military school and tanks and armored vehicles have been ordered.

Dr. Goh also said that five infantry battalions would be fully operational by next year, when a sixth battalion would be formed. One brigade headquarters has been established, a second will follow next year and an artillery battalion will be operational by mid-1969, when another will be raised.

One battalion of engineers is to be fully operational by the middle of next year.

The People's Defense Force now has three infantry battalions and a fourth will be added next year, Dr. Goh said.

Apart from 23 members of the Israeli defense mission now serving as instructors and advisers, the armed forces are made up entirely of Singapore officers and men, he added.

He said Britain's plan for accelerated withdrawal from the Singapore-Malaysia area had totally upset the assumptions on which Singapore's first defense plans were made and an entirely new plan had had to be drawn up.

Figure 6. The *New York Times* article on Singapore's 10-Year Defense Plan.[120]

In 1967, Singapore adopted the IDF's strategy of achieving security through deterrence, applying national services to all able-bodied young male non-Arab citizens and apply a strategy of forward defense.[121] Because of Singapore's limited population, its

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[119] Huxley, 11.

[120] "Singapore Plans a Big Build-Up of Military Force Over 10 Years," *New York Times*, December 4, 1968, 16, ProQuest, http://search.proquest.com/docview/118318147/

[121] Tan, Singapore's Defence, 454.

military buildup competed with its need for labor to fuel economic development. Therefore, as Huxley wrote, Singapore chose to build a "citizen army based on conscription and long-term compulsory reservist service."[122] The National Service Bill was introduced in parliament in 1967; this bill stated that Singaporean men who on or after January 1, 1967 reached the age of 18 years old were qualified to be called up for military service. During this period, only ten percent of those who qualified for the National Service would be assigned to function as National Service Force (NSF)—Singapore's conscript force—because at that time the SAF did not yet have enough facilities or military trainers. The first graduates of this recruitment served for two to three years as regular soldiers and, after ten years of training, as a reserve element until reaching the age of forty; the left out recruits were assigned as part-time personnel as part of the People's Defense Force, a Singaporean unarmed Vigilante Corps, or the Special Police.[123]

Just days after March 14, 1967, the day the Singapore Parliament passed the National Service bill, MID, along with Central Manpower Base, the recruitment center, began sending the drafting notices to more than 9,000 qualified young male citizens. Thus, Singapore successfully introduced the National Service, aimed to support the ambitious development of the SAF, which in the first year, meant to intake a conscription of 18,000.[124]

However, despite the National Service implementation, Singapore had a fundamental fear of neighboring countries, which could still jeopardize its domestic politics and economic growth. In response to that concern, Singapore's sense of inferiority in being a Chinese population surrounded by large Malay countries, led Singapore to follow, for the most part, their advisers', the IDF's, guidelines for developing their military power. Therefore, Singapore sped up its military development even more using the strategic planning method based on guidelines made by the Israeli adviser team.

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[122] Huxley, *Defending the Lion City*, 11.

[123] Huxley, 13.

[124] Huxley, 13.

Singapore's approach during this time can be considered top-down defense planning since SAF was ordered to adopt Israel's military strategy, imposed by the top leadership in order to tackle any threats imposed by its neighboring countries. The SAF utilized its current capabilities and focused on strengthening its force. It benefited from the Israeli defense strategy, based on the concept of pre-emptive defense, which posited that a ferocious and strong military posture will be effective in preventing potential threats from taking shape.[125] Therefore, Singapore utilized its balance of threat strategy that can be considered as the "threats and vulnerabilities" defense planning approach and developed a credible military force to nullify their neighbours' future threats in attempts to defend its national interest.

In addition, Singapore leveraged its position as an international trading crossroads, gaining recognition as the busiest port in the world as measured by the total tonnage of shipments handled annually.[126] Hence, Singapore's defense strategic planning and policy were developed based on the concepts of deterrence and diplomacy. As it viewed itself as non-aligned, trying to build friendly relations with all possible partners. Therefore, Singapore participated in many international organizations, for instance, Singapore's participation in the Association of Southeast Asian Nations (ASEAN) and the World Trade Organization (WTO).[127] This plan was conducted to get international recognition as well as defend the state from any potential danger from its neighboring Malay-states.

While it worked closely with Israel, Singapore still tried to maximize its opportunities by seeking any kind of benefits it could get from its former colonizer, by putting this option in the 1966 Defence Plan—for instance, the plan of building up the RSAF with the main combat force of 40 secondhand Hunter fighters and 12 Canberra bombers from the Royal Air Force (RAF).[128] Other examples of taking advantage of every

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[125] Andrew T. H. Tan., "Singapore's Defence: Capabilities, Trends, and Implications," *Contemporary Shoutheast Asia, 21*(3), (1999): 454.

[126] Jonathan D. Mosier, *The National Interests of Singapore: a Background Study for United States Policy*, Monterey: Calhoun, Institutional Archieve of the Naval Postgraduate School (1993), 11.

[127] Ron Matthews and Nellie Zhang Yan, Small Country "'Total Defence': A Case Study of Singapore," *Defence Studies, 7*(3), (2007), 376–395.

[128] Huxley, *Defending the Lion City*, 20.

opportunity, even benefitting from the planned-to-be-withdrawn British troops, are shown in the formation of the embryo of the Singapore naval force, the SNVF. It served sea patrols in the Singapore Strait on smuggling duties and the protection of fishing vessels and other small craft. By then Singapore had sought assistance from the British in creating the air force, as well as from New Zealand for the navy. Singapore's utilization of the existing defense facilities, built by the British, was shown when the SNVF was assigned as the Sea Defense Command and moved from its old base in Telok Ayer Basin to a site at Pulau Belakang Mati (now Pulau Sentosa), formerly used by the British Army.[129]

In sum, following independence in 1965, Singapore implemented a relentless process of strengthening its military. The potential regional conflict at that time, apart from being the main reason for the SAF development, could also have been a disruptive factor. Therefore, Singapore's military capabilities had to be flexible and credible all the time.[130] Even though Singapore sensed its strategic uncertainty during the early development of SAF, it is clear that the sustainability of Singapore's military development was helped by the nation's political will, aided by the longevity of the regime in power since independence. Moreover, Singapore's sustainable economic development and military development also portrayed its perception, i.e., its basic insecurity with respect to the threats within its volatile region.

The opportunity of getting valuable support from abroad lent Singapore a fruitful time in establishing their defense posture. It had successfully taken the Israeli defense concept into account, formalized the predefined threats and future challenges, and adopted them in its strategic planning, the 1966 Defence Plan, during the SAF development in the 1960s–1970s. By implementing the Israeli concept, Singapore expanded its military forces, received international recognition, and successfully ceased the potential threats.

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129 Goldrick and McCaffrie, *Navies of South-East Asia: A Comparative Study* (Routledge, 2013), 138–139.

130 Tan., "Singapore's Defence: Capabilities, Trends, and Implications," 451–474, 452.

B. 1G SAF (1970S–1980S) "POISONOUS SHRIMP"

Successfully expanding its military forces, Singapore confidently continued its top-down military modernization style, based on its 1966 Defence Plan, with predefined future assumptions and guidance, reflecting the application of strategic planning. The fruition of its education and training investment filled the SAF leadership with well-educated officers; therefore, during this period, the SAF also started to explore more flexible and innovative development concepts.

The 1G posture was symbolized by Singapore's leaders, as "Poisonous Shrimp"—"easy to swallow but impossible to digest."[131] Given the SAF's deficiencies at this point, the nation would be defeated in a war with any of its neighbors but would, in the process, inflict upon the attacking state's armed forces a high level of destruction in what Tim Huxley, in *Defending the Lion City*, characterizes as an unwinnable war on its own territory.[132] The idea was that, hopefully, the thought of suffering such numerous casualties would be sufficiently painful to deter a potential aggressor from attacking Singapore. To achieve this strategy, the SAF was designed to keep Singapore secure up to the shoreline's edge only, so army development was prioritized.

To that end, during the early 1970s, Singapore exercised its strategic plan of expansion and acquisition, which was developed by the Israeli military based on Singapore's geostrategic vulnerability and difficulties in securing its territory, as well as the Vietnam War. In accordance with the strategic plan, Singapore kept expanding its army, expanding its defense organization, and purchasing modern armaments, mostly from its allies, Israel and the Western Bloc. In this period, the Singapore Armed Forces began to reveal the structure and function of its organization, while still investing heavily in personnel education and training.

131 Laksmana, "Threats and Civil-Military Relations," 354.

132 Huxley, *Defending the Lion City*, 57.

One course of action that evidenced the continuity of Singapore's strategic planning implementation during the 1G phase was the Singapore's army's order of battle[133] expansion. During this time, the Singapore army grew rapidly, as planned and stated in its strategic plan, forming the desired twelve battalions based on conscription. By 1976, the Singapore army operated three reservist brigades, and SAF had enough soldiers to build its first army division.[134] It was designated the 6th Division, while the second army division, the 9th Division, was formed two years later. By 1978, the size of the SAF had expanded four-fold compared to its 1965 posture.[135] More quickly than the infantry branch, the army armored branch was formed in 1968, equipped with just a type APC, the Vehicle Commando Unit.[136] The next unit included a more sophisticated system, the AMX-13 light tanks; Singapore purchased 200 units from the Israeli inventory surplus in 1969.[137] Lee took advantage to exercise Singapore's deterrence policy by ordering the AMX-13 to take part in the National Day parade at the Padang, in 1969,[138] to which he specially invited the then Malaysian Prime Minister, Tunku Abdul Rahman; as Lee described the tank parade, "it had a dramatic effect."[139] This deterrence grew stronger in 1975 when the SAF added 63 Centurion Mk3 and Mk7 main battle tanks (MBT) from India. The fact that Malaysia and Indonesia had no MBT meant that the SAF modernization achieved its goals successfully as aimed by its strategic plan, in ten years.

The second course of action that evidenced the continuity of strategic planning implementation during the 1G phase was Singapore's willingness to secure its territory and national interests based on its spirit of self-reliance, which was the essence of its strategic

133 Order of battle: an armed force's combat posture, command structure, personnel disposition, strength, and equipment formation.

134 Huxley, *Defending the Lion City*, 17.

135 Bernard Fook Weng Loo, "Maturing the Singapore Armed Forces: From Poisonous Shrimp to Dolphin." In *Impressions of the Goh Chok Tong Years in Singapore*, edited by Welsh Bridget, Chin James, Mahizhnan Arun, and How Tan Tarn, SINGAPORE: NUS Press, 2009, 79.

136 Huxley, *Defending the Lion City*, 131.

137 Huxley, 130.

138 Tomba, *Beating the Odds Together*, 57.

139 Tomba, 57.

plan. In the training sector, Singapore began its next expansion in 1971, when it built *Pulau Berani* in Keppel Harbor as the site for a new naval base. At that time, the establishment of a technical training school and officers' training school, as well as the expansion of the School of Maritime Training, which was renamed as the School of Naval Training, allowed the SAF to be well situated for patriating all training to Singapore without any foreign advisers. This achievement meant that SAF had moved a step closer to self-reliance, since it had depended on foreign assistance, in training its prospective forces in the School of Naval Training.

The third course of action that evidenced the SAF and MID organization expansion, in accordance with Singapore's defense strategic plan, was the 1966 Defense Plan. In August 1970,[140] Singapore expanded the MID into two distinct ministries: Ministry of Defence (MINDEF) and Ministry of Home Affairs (MHA), which the Singapore Police Force (SPF) and the internal intelligence, Internal Security Department (ISD), came under the MHA. The assignment of SPF to internal security concerns distinguishes the 1G SAF from the SAF's initial phase. This effort was followed by the establishment of the three-armed forces branches as distinct identities on April 1, 1975 when the RSN was built as an independent armed service.[141]

The fourth course of action that evidenced the implementation of Singapore's predefined threats in warfare scenario exercises. Singapore's most likely enemy, Malaysia, was always the main adversary in SAF warfare scenario exercise. The scenario for war with Malaysia has been played out repeatedly in every SAF exercise, as well as in its staff college wargaming, since the late 1960s.[142] This scenario was based on the assumption of a requirement of SAF's invasion of the southern part of the Malayan peninsula, establishing a "Mersing Line" or secure zone approximately 80km into Malaysian Johor territory.[143] This scenario came from various potential causes, from Malaysia shutting off Singapore's

[140] Huxley, *Defending the Lion City*, 14–16.

[141] Goldrick and McCaffrie, *Navies of South-East Asia*,140.

[142] Huxley, *Defending the Lion City*, 59.

[143] Huxley, 59.

water source to the prospect of helping Malaysia to defend itself from Vietnamese aggression (Southeast Asian communist domino effect). However, at the same time, while it continued to implement its strategic plan, Singapore experienced dynamics beyond its strategic plan. Therefore, it explored the possibility of potential courses of action outside its formalized strategic plan. The Vietnam war led to security cooperation, and a manpower surplus led to more selective institutions and better military scholarship.

The first way in which Singapore departed from its strategic plan during the 1G phase was security cooperation, which it pursued to address anything beyond its traditional threats. Singapore reconsidered the significance of its western allies, despite the participation of Malaysia, by maintaining its own participation in the agreement, which was not part of its strategic plan of self-reliance. Around the late 1960s, the regional dynamic, particularly the development of the Vietnam war, exceeded Singapore's predicted challenges. Therefore, Singapore implemented an approach that, in retrospect, looks like the Osterwalder Business Canvas's key partners block, a concept of innovation formulation, which emphasizes the importance of finding a more capable partner in order to overcome bigger challenges to compensate the British forces' withdrawal: Singapore turned to its Western partners. Therefore, in 1971, Singapore joined the five commonwealth-based security partners and met in London to formalize a defense scheme for Southeast Asia before the British forces' withdrawal. The meeting resulted in a joint communiqué called Five Power Defense Arrangement (FPDA; UK, Australia, New Zealand, Malaysia, Singapore), issued on April 16, 1971, which defined a new arrangement of the British Commonwealth to defend Malaya and Singapore, which was previously under the British responsibility.

The second way Singapore departed from its strategic plan was the establishment of the foundation of the future innovation engine within the SAF. Around 1971, Singapore's MINDEF established a study group, the Electronic Test Center (ETC), under orders from first defense minister, Dr. Goh Keng Swee.[144] As described by Teo Chee Hean, a former defense minister, the ETC group serves as a platform for the development

[144] Raska, *Military Innovation in Small States*, 156.

of Singapore's "defense technology ecosystem" based on cutting-edge technologies. This group consisted of 5,000 defense scientists, logisticians, military procurement experts, and engineers working at MINDEF, SAF, the Defense Science and Technology Agency (DSTA), Defence Science Organisation (DSO) National Laboratory, research institutes, defense industry, and universities. This decision was also strengthened by the effort to nurture innovation through the SAF's rigorous training program. Singapore experienced a surplus of manpower in the early to mid-1970s, such that there were a greater number of eligible NS registrants—32,000 recruits in 1976—than the SAF could use.[145] Therefore, SAF only called the fittest and academically brightest; this policy also aligned with the SAF military scholar program.[146] However, around the late 1970s, the SAF's modernization contradicted the "Poisonous Shrimp" characterization and required a reformulation of Singapore's defense doctrines.

To sum up, despite the thriving critical thinking, SAF's modernization during the 1G phase cannot be separated from strategic planning, which emphasized expansion through quantity and acquisition. At the same time, Singapore also explored a possible departure from its strategic plan in response to the emerging dynamics. This trend would increase even more in the next phases.

C. 2G SAF (1980S–2000S) "PORCUPINE"

The 2G SAF transitioned from its "Poisonous Shrimp" character, which was criticized by the SAF's well-educated officer corps, to the "Porcupine." Despite the existence of the previously planned programs, the SAF successfully nurtured innovation, by encouraging and facilitating innovations even more, propelled by the thriving critical thinking culture among its officer corps. However, the well-functioning but inflexible military strategic planning inhibited innovations from turning into disruptive change.

The first course of action evidenced the SAF's nurturing innovation effort was the thriving critical thinking among its leadership. In this stage, Singapore's heavy investment

145 Huxley, *Defending the Lion City*, 95.

146 Huxley, 109.

in military personnel education paid off, manifested in the quality and maturity of the SAF's domestic defense planning capacity and military combat capabilities.[147] The highly educated military leaders, who openly criticized the existing doctrine and laid out future SAF development concepts based on measurable variables and strong argumentation, while encouraging the critical thinking culture, is a stronger indication of the existence of an "innovation incubator," a good environment for nurturing innovation.[148] The culture of critical thinking and the official efforts to nurture it began producing tangible results. For instance, when the SAF felt that the Poisonous Shrimp doctrine was deficient in addressing Singapore's national defense efforts, such as when, on January 9, 1982, Brigadier-General Lee Hsien Loong, SAF Chief of Staff at the time, delivered his speech at the National University of Singapore: "If someone threatens to step on us, and our only alternatives are suicide or surrender, then there will be a very strong argument for surrender. So, we need a policy which says: 'If you come, I'll whack you, and I'll survive.'"[149] BG Lee addressed that the "Poisonous Shrimp" was a defeatist doctrine and unsuitable for Singapore's future challenges.

As a result, in the mid-1980s, the SAF explored the flexible approach—innovation—by conducting experiments in the area of planning and implementing operations at the system level. The previous phase was based on quantity expansion. The shift is targeted to improve the capabilities of domestic military technology with the goal of increasing and maintaining the operational readiness of SAF units in the most efficient manner.

The second course of action based on innovation was the support from Singapore's legislative and executive branches, which consisted of retired SAF leaders or at least ex-NSFs, toward nurturing innovation within the SAF. As innovation is not only about producing ideas, but also applying them in the field, innovative ideas were taken seriously, and most were implemented as SAF official doctrine. Around the1990s various academic

147 Raska, *Military Innovation in Small States*, 142.

148 Raska, 190.

149 Raska, 142.

articles, written by SAF personnel, were published by the *Pointer – Journal of Singapore Armed Forces*, the SAF academic journal. For instance, as noted by Raska, journal articles such as "Application of Advanced Military Technology in Desert Storm" (Leong Sek Kay 1995), "Revolution in Military Affairs and Command, Control, Communications and Computers (C4): Are We Ready?" (Lim 1998), "The Impact of Technology on the Military: An SAF Perspective" (Chen 1999), and "Joint Vision 2010: The Concept of Future Warfighting for the U.S. Armed Forces and its Relevance to the SAF" (Tay 1999) explored the strategic implications of advanced information technologies in combat and, more importantly, its impact on the SAF.[150] These articles triggered an internal debate, as intended, which continued to the higher level, a debate between lawmakers and the SAF officer corps, and then ideas moved to the field experimentation level.

An experimentation example was when the SAF developed an interest in the use of space in augmenting its existing C4ISR networks. In conjunction with the Nanyang Technological University and Surrey University and Surrey Satellite Technology, Defence Science Organisation National Laboratories launched a satellite project, it was Singapore's first domestically designed and built.[151] This satellite was not only designed for environmental monitoring functions but also provided a technological learning platform for future exploitation and use of Singapore's military satellites. A potentially significant development was the June 2000 agreement for further participation in the development of Israel's *Ofeq* satellites, leading to future operations by the Singapore Ministry of Defence (MINDEF). This project will likely enhance the SAF's capacity to provide space-based surveillance and monitoring of the immediate strategic environment. Another piece of evidence was the Advanced Combat Man System (ACMS). Launched in 1998, the ACMS program aimed to "leverage cutting edge technologies as force multipliers to increase the SAF soldiers' C4I, lethality and survivability, by symbiotically linking soldiers to soldiers, platforms and sensors, via a suite of wearable computer tactical communications and integrated weapons systems on the soldier."[152] Since the early 1990s, the military of

[150] Raska, *Military Innovation in Small States*, 148.

[151] Loo, "Maturing the Singapore Armed Forces,"182.

[152] Raska, *Military Innovation in Small States*, 156.

developed countries have begun to explore network-centric warfare and make it a major strategic imperative.

The evolution of ideas into an effective doctrine can also be seen in the early 1990s, when the SAF followed the 1st Gulf War closely. Based on lessons taken from what happened to the Kuwaitis, the SAF emphasized the need for achieving a "swift and decisive victory over aggressors,"[153] which led to a doctrinal shift, this time towards joint operations. The necessary precursor was a mature conventional warfighting doctrine that, at least in land operations, emphasizes the seamless integration of artillery, armor, infantry and other fighting services into combined arms operations.

The third course of action that evidenced the innovation-based strategy formation was the implementation of what looked like the Osterwalder Business Canvas key partners block to find Singapore's potential security partner. In the defense realm, which does not have a profit margin as a benchmark of performance or direction, the Osterwalder canvas helps invent the strategy a defense organization should take, especially in finding key partners. Singapore's deficiencies forced it to rely on the assistance of other countries for its survival, which was not part of its plan for self-reliance. Nevertheless, it formed a bilateral relationship between Singapore and the United States, based on mutual advantage and common interest. In 1990, Singapore's prime minister, Lee Kuan Yew, and the U.S. vice president, Dan Quayle, signed a memorandum of understanding to grant U.S. forces access to Singapore's air and naval base facility, Changi.[154]

The fourth course of action that evidenced the SAF's innovation application was Singapore's handling of the declining birth rate, with force optimization around the mid-1990s. Beginning with the Army 2000 doctrine, the Singapore army's derivative of the SAF 2000, completed in 1988, the Army was reorganised into genuine combined arms divisions, integrating not only armored and artillery forces with infantry brigades, but also

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153 Bilveer Singh, "A Small State's Quest for Security: Operationalising Deterrence in Singapore's Strategic Thinking," in *Imagining Singapore*, ed. Ban Kah Choon, Anne Pakir and Tong Chee Kiong (Singapore: Times Academic Press, 1992), 57.

154 Prashanth Parameswaran, "What's in the Renewed US-Singapore Military Facilities Agreement?" *The Diplomat*, September 28, 2019. https://thediplomat.com/2019/09/whats-in-the-renewed-us-singapore-military-facilities-agreement/.

reservist (National Service) and active units. Army 2000 emphasized offensive combined military operations as well as the ability to perform a "24-hour battle." This concept of joint operation was absent from the SAF strategic plan; however, this concept emerged from the SAF's urgency to optimize its manpower due to the 1980s declining birth-rate dynamic. This was an innovative policy, but not part of Singapore's strategic plan. This approach took place because the ruling People's Action Party (PAP) had successfully implemented a policy to reduce the birth-rate since the mid-1960s. The Singapore government was warned about this shortfall, as the annual National Service Force (NSF) intake fell from 32,000 in 1976, to 20,000 in the mid-1980s, to 15,000 in late 1980s.[155] As Huxley describes, the main innovative initiatives are:

- Commercialization of non-combat support services, such as supply bases and catering, reducing the demands on NSF manpower in those sectors. In addition, some support services were assigned to female regular personnel, non-uniformed SAF personnel, and civilian MINDEF employees.

- Utilization of technology to minimize manpower requirements. To this end, weapons and other equipment were modernized, to benefit from technologically advanced weapons, and the use of simulators and computer-aided instruction was stepped up.

- A restructuring of the army order of battle, with smaller formations and units maintaining their firepower and combat effectiveness with upgraded equipment.

- Improvement of administrative productivity, through the use of computers and office automation systems.

- Improvements to basic military training, especially in terms of reducing the attrition of otherwise combat-fit NSFs through training injuries. The systems for selecting officers (including non-commissioned officers) and NCOs were also renovated.

- Refinement of the medical classification system to allow the assignment to certain combat posts (as headquarters signalers, for example) of NSFs who would previously have been classed as unfit

[155] Huxley, *Defending the Lion City*, 95–96.

for combat duties (approximately halving the previous annual figure of 3500 SAF NSFs who could not be given combat roles).

- The provision of more challenging roles and responsibilities for NSFs. For example, NSF armored vehicle drivers are now cross-trained as mechanics to allow them to repair their own vehicles. Some NSFs are now trained as middle-level "specialists" (as NCOs other than warrant officers are known in the SAF).[156]

This force optimization policy was followed by increased interest and investment in the area of electronic warfare systems and the integration of advanced information and communications technologies to generate new concepts and approaches in command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) that would give the SAF the operational holy grail of "dominant battle-field awareness." This idea could be traced back to one of SAF's innovation articles—Lim's 1998 article—"Revolution in Military Affairs and Command, Control, Communications and Computers (C4): Are We Ready?" This aspect placed the SAF within an elite, and very small, band of cutting-edge military organizations capable of engaging in the so-called revolution in military affairs (RMA), first heralded by Operation Desert Storm.

The fifth course of action that evidenced the SAF innovation was Singapore's intention of benefiting more from its defense acquisitions, by gaining technology and skill transfer as well as saving Singapore's foreign exchange by minimizing the country's defense import. As Bilveer Singh argues, "defence industries are … the political industries of a country," aiming to reduce dependency on foreign suppliers and to provide self-sufficiency. He further argues that "one of the many responses of the PAP in overcoming the survival crisis was to establish a viable defence capability, and with that was implanted the seeds of the local defence industry."[157] Therefore, around the 1990s, fundamental changes took place in Singapore's defense industry sector, first, in the form of privatization of the leading defense industry company, Singapore Technologies (ST), which dramatically reduce Singapore's dependence on MINDEF defense contracts. This group

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156 Huxley, 96–97.

157 Bilveer Singh, "Singapore's Defence Industries," *Canberra Papers on Security and Defence*, No. 70 (Canberra: Strategic and Defence Studies Centre, Australia National University, 1990), 38.

has obtained most of its business from the maintenance and repair of SAF equipment and attempts to produce non-local military systems, either through licensing or independently designing and producing military hardware. Although the military business remains the core business of ST, contributing 70 percent of its total revenue, there are joint efforts to expand operations in the field of civilian business. Furthermore, the ST has also begun to play an important role in facilitating the transfer of defense technology to the civilian sector; this is possible because of the large number of civil contracts it undertakes and the emergence of innovations and dual-use technologies. Also, before the privatization process, ST had begun to consider the profit potential of the defense industry sector, which was most clearly demonstrated in the export of weapons and equipment that were designed and produced locally. Excellent examples of such export success are the export contract of the SAR 80 assault rifle and the Ultimax-100 submachine gun and the Self-Propelled Howitzer 1 contract—called Primus—by the Singapore Armed Forces in November 2003.[158] The development and launch of Primus are the work of the consortium of the Defense Science and Technology Agency MINDEF, SAF, and ST Kinetics. Even though this benefit optimization was not part of the strategic plan, in the end, the ST group of companies managed to become an internationally recognized player in the global arms market, even though it was not as big as Israel.

The sixth course of action that evidenced the SAF innovation, based on economic concerns, was the implementation of something like the "sticky note" concept in the Osterwalder canvas, in experimenting with the future potential defense systems, which mostly required a high cost, by experimenting with the less costly option. This innovative policy, which emphasized flexibility, was the RSN purchase of secondhand Swedish submarines, which provided RSN with an affordable platform to conduct organizational experimentation and personnel familiarization. In September 1995 the RSN announced the acquisition of an ex-Swedish Navy Type A 12 Sjöormen class submarine, to provide familiarization prior to building a future submarine force of up to six boats. In April 1996, the crew began training in Sweden and in July 1997, Singapore announced the purchase of

[158] Bilveer Singh, "Singapore's Defence Industries," 85.

three more of the submarines. The first of the four arrived in Singapore in May 2000. Delivery took place after a comprehensive program of reconditioning and adapting for tropical conditions.

Several other Southeast Asian navies had longstanding ambitions for operating submarines, but were overwhelmed by the cost and complexity. Singapore's becoming the first to do so was notable for being an exception to its usual caution in introducing new technologies to the region and confirmed its economic strength, even as the Asian financial crisis unfolded around it. The introduction of the submarine arm confronted the Singapore Navy with several challenges, many of them personnel related, with implications for other aspects of its intended expansion. RSN took lessons from this and made improvements for the next submarine systems.

However, despite the thriving innovation, Singapore also kept engaging with strategic planning, evidenced by publishing a 1995 MINDEF white paper,[159] intended to serve as guidance instead of controlling the innovation, but it did prevent SAF's innovations from being too disruptive. According to this defense document, "Singapore's defense philosophy is not built on the premise of an existing external threat. Instead, Singapore invests in defense to enhance its deterrence capability. As a sovereign state, it must be self-reliant in its defense to prevent threats from arising in the first place. Total Defence is thus the cornerstone of Singapore's deterrence strategy. It unites all sectors of society—government, business, and the people—in the defense of the country."[160] This defense document also explained the concept of a three-dimensional "S-Cube Concept": "Survival, Security, and Success are the building blocks of Singapore's future. The three elements are intertwined inextricably. Survival is the imperative of every nation. But there cannot be survival without security. At the same time, without success there will not be motivation to persevere."[161]

159 Raska, *Military Innovation in Small States*, 144.

160 Raska, 145.

161 Raska, 144.

The implementation of SAF's Total Defence doctrine dates to its 1980s internal journal articles and its exploration of several similar strategies applied by Israel, Switzerland, and Sweden in the early 1980s—countries with relatively small populations which also implement a national compulsory military program.[162] This idea was then introduced in 1984 by Brigadier General Lee Hsien Loong in his speech "Security Options for Small States."[163] After much discussion and debate, SAF laid out a Total Defence system, as the result of self-critique, the Total Defence concept in this stage engaged in Singapore's MINDEF. As Matthews and Yan argue, "The MINDEF is attached to technological prowess suggesting that it is essentially the unwritten sixth component of the Total Defence concept."[164] By implementing this doctrine, Singapore was able to propose five key elements of Total Defence. It consisted of psychological defence, civil defence, social defence, economic defence, and military defence. It was also underpinned by the fact that the SAF in the early 1980s had become "a practically unstoppable military force" compared to its regional counterparts, who were numerically superior but almost certainly qualitatively (in technology, doctrine, and training) inferior.[165] This concept serves as guidance to all the SAF's innovation and development. Therefore, the Total Defence restrains innovation, inhibiting it from becoming negatively disruptive. For instance, as Huxley argues, the MINDEF structures its procurement process in five phases—derived from the Total Defence doctrine—which includes: a five-year acquisition master plan, requirements definition, bid evaluation, in-service acceptance, and life-cycle review.[166] The existence of the acquisition master plan acts as guidance, that sets SAF's procurement priorities, which automatically controls all changes in the SAF.

In every sense, the cornerstone of Singaporean national security is the adoption of an all-embracing approach towards Total Defence, viewing itself as non-aligned, seeking friendly relations with all states. It actively participates in international organizations, such

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[162] Raska, 143.

[163] Raska, 143.

[164] Matthews and Yan, Small Country 'Total Defence', 388.

[165] Loo, "Maturing the Singapore Armed Forces," 180.

[166] Huxley, *Defending the Lion City*, 176–177.

as the WTO and ASEAN, and also serves as a rotational member of the United Nations (UN) Security Council (2001–22). Deterrence, the other aspect of defense, is rationalized on the basis that Singapore must possess the capacity to deter, in the event that diplomacy fails.

Overall, the SAF experienced remarkable developments in doctrine, defense systems, and significantly in its culture. Its critical thinking culture, supported by the retired SAF leaderships who served at the government to nurture innovation, propelled the SAF modernization way beyond its neighbors. However, the existence of the 1995 MINDEF defense white paper, though intended to guide the thriving innovation, also inhibited the disruptive dilemma of thriving innovations.

D. 3G SAF (2000S-2030S) "DOLPHIN"

Despite the long discussion that preceded the implementation of the "Dolphin" phase, as Raska notes, the idea of the "3G SAF" officially came to public through the "Statement at the 2004 Budget Debate in the Singapore Parliament" by then Minister for Defense Teo Chee Hean on March 15, 2004.[167] Raska also observes that the Dolphin phase aims to implement a transition towards a combined strategy of a multi-mission military force capable of carrying out functions "from defense diplomacy to kinetic integrated capabilities toward a wide spectrum of threats."[168] He also added that this phase "networked SAF, leveraging precision fires, maneuver, and information-superiority capabilities."[169] In this stage, Singapore has enjoyed the fruits of its investment in nurturing military innovation: innovation is everywhere, able to function in the RMA, and SAF has been categorized as the most modern military force in the region.[170] Therefore, Singapore permanently institutionalized innovation by forming a dedicated institution. However, in the application of military innovation, the SAF seeks to balance, one,

167 Raska, *Military Innovation in Small States,* 147.

168 Raska, 131

169 Michael Raska, "4G SAF: Creating New Advantages," RSIS comentaries, 2017, https://dr.ntu.edu.sg//handle/10356/83194.

170 Institute for Strategic Studies, "Chapter Six: Asia." *The Military Balance* 119, no. 1 (February 1, 2019): 303. https://doi.org/10.1080/04597222.2018.1561032.

maintaining proven strategies and structures with the adaptation of innovative operational concepts and, two, organizational structures based on RMA-oriented military-technology modernization in maintaining preparedness in the face of increasingly complex potential conflicts.[171]

Teo Chee Hean, who was then the minister of defense, conceptualized this 3G phase as a form of gradual defense management reform, organizational and operational adaptation, which began from within MINDEF itself. He divided the SAF 3G transformation into a three-phase development approach:

- In the first phase, the SAF would acquire new equipment, introduce progressively more capable systems, and establish new units to enable the transformation of the SAF into an advanced, networked force.

- In the second phase, the SAF would set up new operational commands relevant with an expanded spectrum of operations, at home and overseas, and, in doing so, focus on widening its operational flexibility and responsiveness.

- In the third phase, the SAF would aim on enhancing its leadership and human capital through the introduction of enhanced career schemes as well as revision of training and curriculum to maintain a steady stream of capable and committed people to meet the requirements of the 3G SAF.[172]

The first indication of the SAF thriving innovation institutionalization in the 3G phase was when the SAF realized the importance of going beyond the competition with the existing foreign military doctrines and operational schools of thought, by thinking outside the box. Therefore, the SAF aimed to develop domestic military strategies and doctrines by encouraging its personnel to capture their thoughts in monographs. For instance, there were SAFTI Military Institute's *Pointer* monographs: *Creating the Capacity to Change* (2003); *Realizing Integrated Knowledge-based Command and Control – IKC2* (2003); and *Spirit and System: Leadership Development for a Third Generation SAF* (2005).[173] The

[171] Raska, *Military Innovation in Small States*, 132.

[172] Raska, 152.

[173] Raska, 148.

second monograph, *Realizing Integrated Knowledge-Based Command and Control: Transforming the SAF*, introduced the character of the main operational concepts underlying the SAF 3G: IKC2, which are "Network-Centric Warfare" and "Effects-based Operations";[174] the first monograph, *Creating Capacity to Change* (C2C), represented a culture of critical thinking designed to stimulate internal debate in the SAF and, as such, enable the SAF to internalize a sustainable adaptive capacity into its structure and culture.[175] However, there is an organizational challenge for MINDEF, and SAF, which is to maintain a hotbed of truly innovative ideas along with regular bureaucracies which have proven to function well.[176] Room for change and continuity must be allocated because both are crucial to the success of SAF as an organization.

The second clear indication the role of innovation engines in the 3G phase can be seen from SAF's institutionalizing innovation—the creation of Future Systems Directorate (FSD) in 2003 and the Defense Research and Technology Office (DRTO) in 2006, which would serve as a "catalyst for transformational change within the SAF."[177] Another example was, Singapore's Osterwalder's canvas lookalike method for military purchases and concept of operations, which offers the flexibility of innovation—for instance, the RSAF F-35B acquisition program, which will buy an initial batch of eight fighters, perform experiment and adaptation, then buy a full squadron if the results are satisfying. Again, this approach provides Singapore with affordable consequences if something goes wrong.

The third indication of innovation in the 3G phase was Singapore's decision to cooperate with their immediate neighbors, who pose Singapore's traditional threat. This decision to cooperate was not part of Singapore's strategic plan, which focused on building capacity and capability to deter threats. The close proximity of Malaysian, Indonesian and Singaporean maritime boundaries and the numerous islands in these waters complicated

174 Raska, 150.

175 Raska, 149.

176 Raska, 149.

177 Raska, 155.

law enforcement efforts and the limited cooperation among the three maritime forces up to this time served to make the counter-piracy task more difficult.

Nevertheless, through the 1990s, attempts were made to improve cooperation, with, for example, Exercise Eagle 12/92 involving the navies of Singapore and Indonesia, in Singapore and in local waters in December 1992. In early 1993, Singapore, Malaysia and Indonesia convened a conference on Malacca Straits security and the upgrading of surveillance systems for the area. Piracy remained a significant threat until the middle of the following decade but the continuing evolution and improvement of multilateral arrangements had progressively greater effects, particularly in Singapore's immediate vicinity.

However, the existence of a less flexible strategy formation, one of a strategic planning character, can also be seen during this phase. One example is Singapore's unchanged security perspective, particularly with respect to its defined vulnerabilities, its dependency on SLOC. As a key hub for transshipment, Singapore depended heavily on international trade, estimated in 1995 to be worth more than three times the national GDP.[178] Singapore's almost-total dependence on foreign sources for its essential needs, and particularly most of its water supply, is another significant vulnerability, which potentially will be disrupted to weaken Singapore during the conflict. Moreover, the Malacca Straits passage on which Singapore depends for most of its survivability needs must pass through its most likely adversaries' territorial waters. Therefore, any minor disruption to Singapore's SLOC would threaten not only its economic well-being but also its existence as an independent nation. While the RSN continued to eschew frigates publicly, the acquisition of bigger ships, possibly large enough to include a flight deck, became increasingly likely. One clear deficiency in the RSN's capacity to assume the SLOC role, with or without maritime patrol aircraft, was a lack of embarked helicopters.[179] The RSN's development was based upon Singapore's highly tuned and increasingly sophisticated understanding of its strategic environment and the potential threats to the

[178] James, and McCaffrie, *Navies of South-East Asia*, 147.

[179] James, and McCaffrie, 144.

country, which was defined in its strategic plan. As a tiny nation-state, it was both the beneficiary of geography and a potential victim. While Singapore's armed forces could combine their efforts and share resources, the country would always lack strategic depth.

The second example of strategic planning implementation was the prioritization of RSN development in the 3G Dolphin phase. This focus on the RSN was part of Singapore's strategic plan, wherein the 1G prioritized the army, the 2G prioritized the RSAF, and the 3G prioritized the RSN development. However, at the same time the RSN modernization also indicates the utilization of innovation, by acquiring the C4I capability, which was developed by the SAF culture of innovation in the 2G phase, in particular by the SAF's academic articles and monographs.

The expansion of the RSN could only have come at the expense of the Army or Air Force, at a time when Singapore's defense effort was competing with the commercial sector for limited financial and human (especially technical) resources, one of the elements in the modernization of the SAF was the upgrade and progressive rearmament of the Sea Wolf class with Harpoon missiles in addition to their Gabriels. Most important was the acquisition of four E- 2C Hawkeye airborne early warning and control (AEW&C) aircraft from the U.S. in 1983. These aircraft could not substitute for much needed maritime patrol aircraft (MPA), but they provided a command and control foundation for devising coordinated tactics for the Air Force and Navy in long-range maritime strike.[180]

A coastal design was selected ahead of an inshore type, indicating the RSN's intent to protect not only the Singapore Strait but "the Malacca Straits SLOCs and the South China Sea." The first minehunter, RSS Bedok, was constructed in Sweden, while the remaining three were built in Singapore.

The RSN was already committed to considerable expenditures even if it simply replaced its combatants one for one. At this stage, the RSN intended to maintain the Sea Wolves into the early part of the next century while replacing the older boats with the same number of larger 57 m units with a new combat system.

[180] James, and McCaffrie, 143.

The RSN had difficulty in retaining technically qualified people, while it also had career patterns that propelled the most talented to senior rank at comparatively early ages. This advancement policy ensured a dynamic and youthful leadership which could move on, after military service, into key national leadership and management roles, but it also strained the RSN's ability to maintain high professional standards and an adequate experience base.[181] Although there are no official documents provide the details of the plan itself, however the RSN development was part of the third phase in its strategic plan and Singapore carried it out.

E. SUMMARY AND CONCLUSION

To preserve the SAF strategic deterrent and maintain its superiority, the SAF decided to start a process of a never-ending modernization. It plans to acquire advanced military technologies and platforms, which cost a lot of Singapore's fortune.

Singapore's intimate defense connections with Israel continue to the present. Singapore's defense doctrine and current strategic posture are heavily influenced by the concept of Israeli defense. In the late 1960s and early 1970s, under the guidance of Israeli military advisors, SAF's doctrine, training, organization, and equipment were developed appropriately to provide the basis for the strategy that was considered as the most suitable for Singapore deterrence through pre-emption in the immediate territory of Singapore. Then in the 1980s to early 1990s, the SAF completed building its limited regional power projection capability—specifically, the capability to protect Singapore's vital maritime lifeline to 1,000 miles from its shoreline in the event of regional conflict.[182]

Based on the separation of Singapore Police Force (SPF) from MID, which was part of the plan, this research proposes a change in the existing SAF evolutionary stages—adding an initial phase called the 0G SAF, as described in Table 4. As cited by Michael Raska, Andrew Tan argues that there is a distinct period of SAF evolution, which was

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[181] James, and McCaffrie, 146.

[182] Weichong Ong, "Peripheral to Norm? The Expeditionary Role of the Third Generation Singapore Armed Forces." *Defence Studies* 11, no. 3 (September 1, 2011): 544, https://doi.org/10.1080/14702436.2011.630182.

Singapore's initial military evolution, assisted by the Israeli military advisers, between the mid-1960s to 1970s,[183] when Singapore's military was merely characterized not as defense forces, but more as security forces due to its low scale, slow speed, and focus on internal threat; and also the SPF was still part of the evolution.

Table 5. New Evolutionary Stages of Singapore Armed Forces[184]

Strategy	Threat Designed to Addressed	Key Focus	Type of Deterrence	Primary Executing Service/s
0G SAF 1960s – 1970s "Initial Phase" Mid	Internal security	Organizational expansion: • Recruitment • Training Maintain internal stability	Constabulary	Army + Police
1G SAF 1970s–1980s "Poisonous Shrimp"	Conventional military threats	Basic defense and survival: • Prevent successful invasion • Maintain internal stability	Passive Deterrence: • Strong defensive capability a. Infantry-centric) • Fight in own territory • Cause substantial damage to enemy	Army
2G SAF 1980s–2000s "Porcupine"	Conventional military threats	Enhanced survivability: • Enhanced deterrence factor • Creation of strategic depth Establishment of regional political space: • Superior military capabilities	Active Deterrence: • Strong pre-emptive military capability a. Armor and airstrikes • Fight in enemy territory; limited sea denial • Win the war or cause unacceptable damage to enemy	RSAF

[183] Raska, *Military Innovation in Small States*, 140.

[184] Adapted from: Yong, "Why Keep Changing? Explaining the Evolution of Singapore's Military Strategy."

Strategy	Threat Designed to Addressed	Key Focus	Type of Deterrence	Primary Executing Service/s
			• Limited protection of economic interests	
3G SAF 2000s–2030s "Dolphin"	Conventional military and non-conventional threats	Enhanced survivability: • Enhanced strategic depth • Full-spectrum dominance Establishment of international political space • Defense diplomacy	Preventive Deterrence: • Overwhelming military superiority a. Network-centric and Joint operations b. Capable of dealing with non-conventional threats • Fight in enemy territory; limited sea control • Cooperation and confidence building a. Information and intelligence sharing b. HADR and OOTW • Prevent thought of harming Singapore to even take shape • Improved protection of economic interests	RSN
4G SAF 2030s–onward	Hybrid threats	Force multiplying	Technological superiority	C4I

The table reveals that each of the categories, from the 0G up to 3G, used a common definition of threats, without describing which actor potentially poses the threat. It also portrays the prioritization (key focuses and services) and desired goals. In the strategy formation, the first three SAF generations (0–2G) mainly utilized strategic planning, with an early exploration of innovation, starting at 1G SAF, which then increased during the 2G. The 3G marked the remarkable thriving of SAF's innovation, not only among its officer corps but among its non-commissioned officers. However, the existence of SAF's well-functioning and efficient bureaucracy provides several advantages in preventing the SAF's innovation culture from being disruptive. Moreover, the application of SAF's old-school method also provides guidance that creates shared values among SAF's personnel and continues through different generations.

To sum up, Singapore's achievement in modernizing the SAF was not brought about by strategic planning or innovation institutionalization alone but by the proper combination of the two. Singapore mainly utilized strategic planning until it reached a secure zone, outpowering its traditional adversaries, around the mid-to-late 1980s. The proper combination of strategic planning and innovation institutionalization successfully gave Singapore the most well-equipped and capable armed forces in the region.

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IV. CONCLUSION

Singapore's military modernization was initially driven by Singapore's expulsion from Malaysia—which led to its independence and enormous efforts in safeguarding its territory and state from any possible threats, such as from Malaysia and Indonesia. Singapore's military modernization seeks to build capable military forces, which can deter any potential threats. However, during the process, Singapore still felt insecure since it assumed that both Malaysia and Indonesia would impose their power against Singapore, whether politically or economically.

Singapore's natural constraints on its demographics, territory, and natural resources became the fundamental focus of defending the state. In its early independence, Singapore sought support from other countries, with Israel and the U.S. as significant supporters regarding its strategic planning for improving the army. The relationship between Singapore and the two countries are strong: even nowadays, the relationship between Singapore and Israel continues.

During the early stages, Singapore implemented a predefined situation-based development—strategic planning—assisted by Israeli military advisers and by their guidance documents, the *Brown Book* and the *Blue Book*.[185] In the next stage, thanks to its heavy investment in training and education,[186] Singapore started to cultivate innovation through its military personnel, academically, through monographs and journals,[187] which increased its modernization pace, backed by a nurturing culture of innovative ideas alongside SAF's regular, well-functioning bureaucracy. In the current stage, its modernization pace is barely challenged regionally, propelled by the remarkable thriving of innovation within the SAF, due to its establishment of dedicated organizations that act as innovation engines. Based on these findings, the early period of Singapore's military development showed a distinctive pattern that differentiated it from its neighbors.

185 Raska, *Military Innovation in Small States,* 139.

186 Huxley, *Defending the Lion City*, 109.

187 Raska, *Military Innovation in Small States,* 148–49.

Ultimately, the less flexible strategic planning method did help SAF modernization during its early period, then the flexible innovation institutionalization method took over gradually from the 1980s. In the 3G SAF, Singapore maintained its technological advancement thanks to innovation institutionalization. The combination of thriving innovation and Singapore's well-functioning bureaucracy refined through early-stage strategic planning kept SAF innovation productive rather than disruptive and inefficient.

To sum up, Singapore's achievement in modernizing the SAF was not brought about by strategic planning or innovation institutionalization alone but by the proper combination of the two. It had the ability to maintain its well-functioning bureaucracy while it flexibly tried and applied more than one method of strategy formation, the combination of strategic planning and innovation institutionalization, for over than fifty years. Despite strategic planning's usefulness in coordinating the whole organization, it comes with flaws and fallacies such as its inflexibility and the uncertainty of its predictions. Therefore, innovation institutionalization provides various advantages to compensate, such as its flexibility dealing with the uncertainty of future challenges. Singapore implemented strategic planning until it reached a steady or safe level, outpowering its most likely adversaries, then started to explore the innovation method.

A. LESSONS LEARNED

The main lesson obtained from Singapore's military modernization is the implementation of a combine approach, strategic planning and innovation institutionalization, instead of one method alone. Singapore's experience provides a reference for regional defense strategists regarding the implementation of various methods of strategy making in the defense realm, especially in military modernization. Moreover, Singapore's modernization phases provide a benchmark to the regional military strategists to assess their military capability. From the early stage, every state should look for assistance and guidance from trusted partners who have more experience in the defense realm to assist in the making of defense strategic plans, especially the initial one. The state can start to explore a new method of strategy making when it has reached a safety zone, where it could mitigate the threat as it is targeted in its strategic plan. It can explore any

new method, such as a new method that emphasizes innovation institutionalization, thriving innovation through innovation engines. The unlimited potential development from the implementation of innovation institutionalization can be extremely useful. However, the disruptive behavior of innovation can lead to a drastic change, which can bring either advantages or disadvantages. Therefore, the proper implementation of some strategic planning is still required to minimize the drastic change effect by providing control through guidelines and coordinating the whole organization.

B. 4G SAF (2030S-ONWARD)

Singapore's MINDEF started to envision the future SAF posture, the so-called "SAF 2030 Force" in 2015, inspired by the development of hybrid threats.[188] Singapore intent to maintain its technological military superiority is manifested in the form of its future military posture, the 4G SAF, which no longer focuses on Singapore's traditional threats. Although it was launched in 2015, it is all about the future posture, which envisions the operation of currently prototyped systems. For instance, this 4G phase explores the possibility of using a micro-unmanned aerial vehicle (UAV) system for individual soldiers; a horse-like robot that can carry very heavy loads and follow soldiers independently; multifunctional robots; unmanned land vehicles (ULV); unmanned surface vessels (USV); cyber defense units; and other high technology that will be integrated into the existing SAF C4I system, which will improve its intelligence capabilities, as well as mobility, agility, and lethality.[189] Overall, as stated by Singapore defense minister, Dr. Ng Eng Hen, this phase "would leverage a multilayered defense network of integrated sensors and shooters across all maritime, air, ground, and cyber domains with increasing emphasis on unmanned systems and platforms."[190]

[188] Raska, 157.

[189] Raska, 157.

[190] Raska, 157.

However, although this phase represents the SAF's intention to adapt and innovate continuously, this phase emanates a huge potential for disruptive changes, distinct from SAF's gradual 0–3G evolution. Moreover, Singapore's natural constraints are unlikely to change.

C. FUTURE RESEARCHES

Singapore's success story in modernizing its military, by combining strategic planning and innovation institutionalization, raises more questions that require further research. For instance, how to formulate the proper combination of the two? If there is an appropriate formulation, can it be implemented universally?

Second, how effective the high-tech 4G SAF is at dealing with conventional threats, such as the South China Sea dispute and the conventional military threat from Singapore's two immediate neighbors. This idea could be analogized as developing a computer virus while enemies are still using typewriters.

Lastly, how might Singapore's existing defense posture, culture, and strategic narrative adjust to and balance the consequences of the disruptive changes? Could Singapore's method of combining strategic planning and innovation still inhibit the 4G's disruption?

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